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Railway Congress Association
(English Edition)

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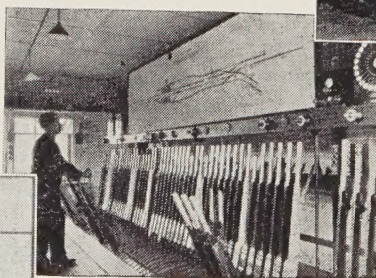
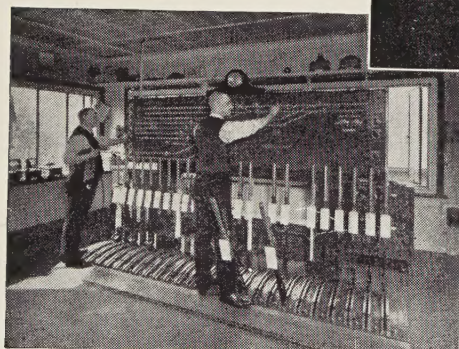
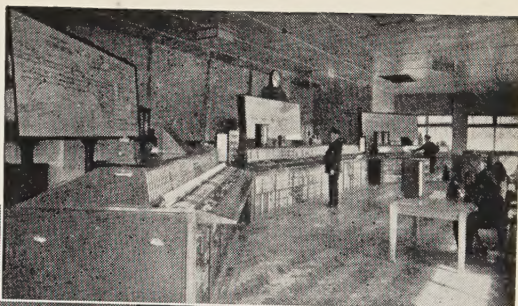
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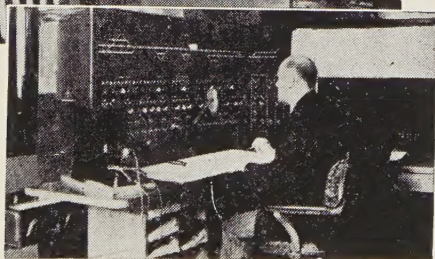
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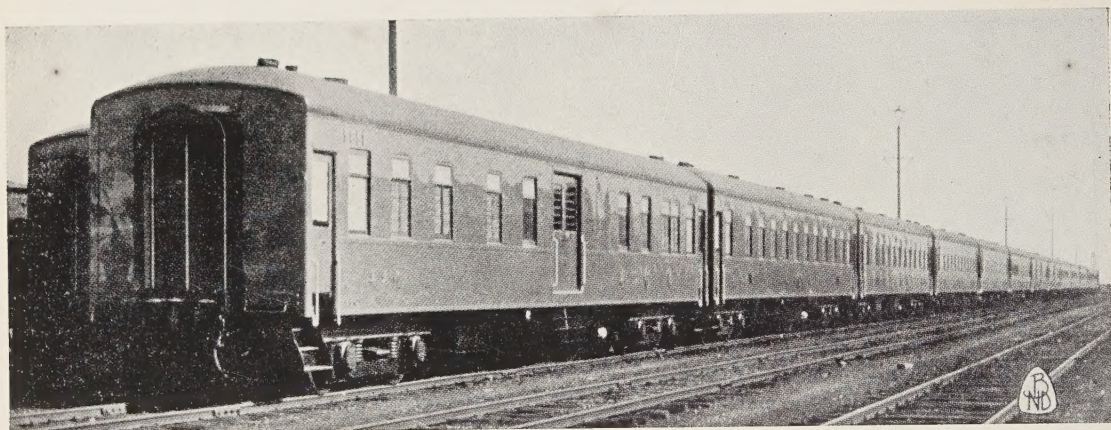
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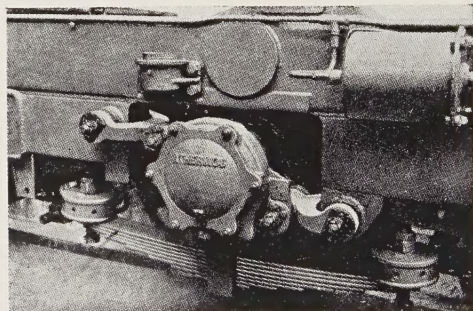
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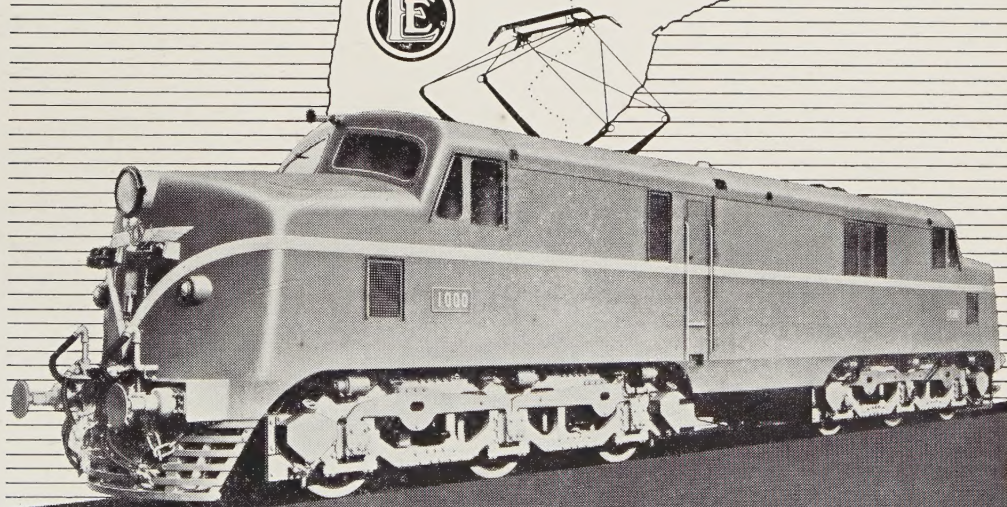
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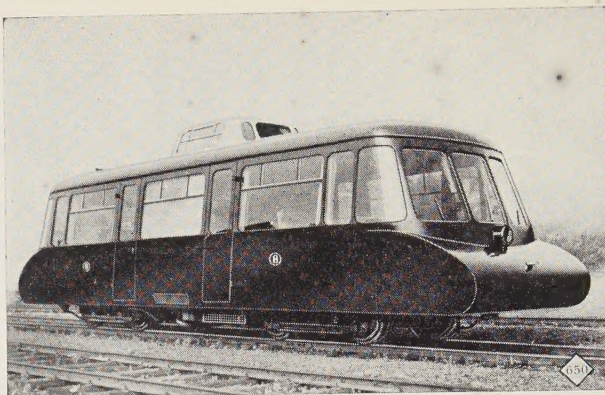


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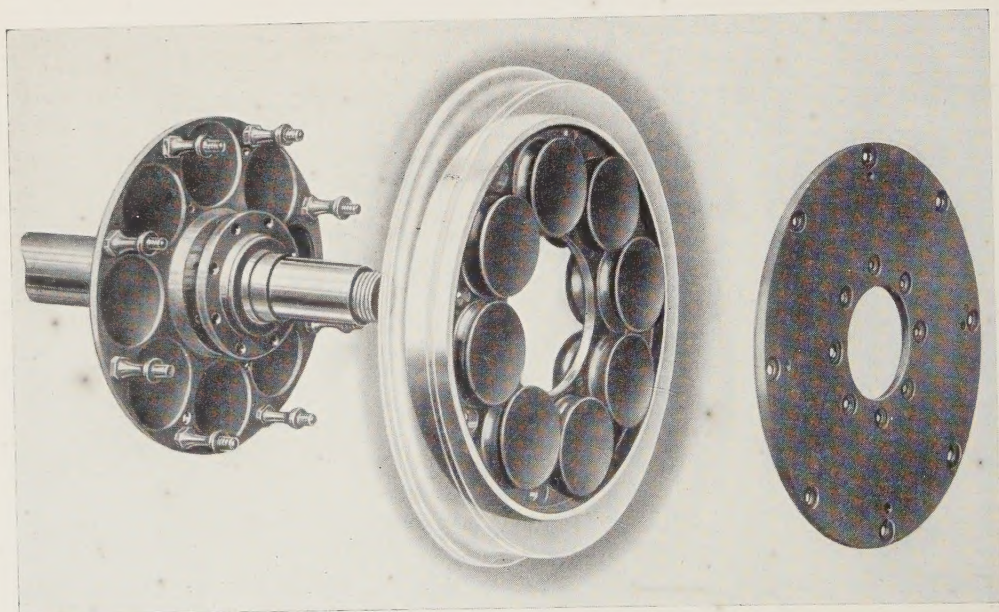
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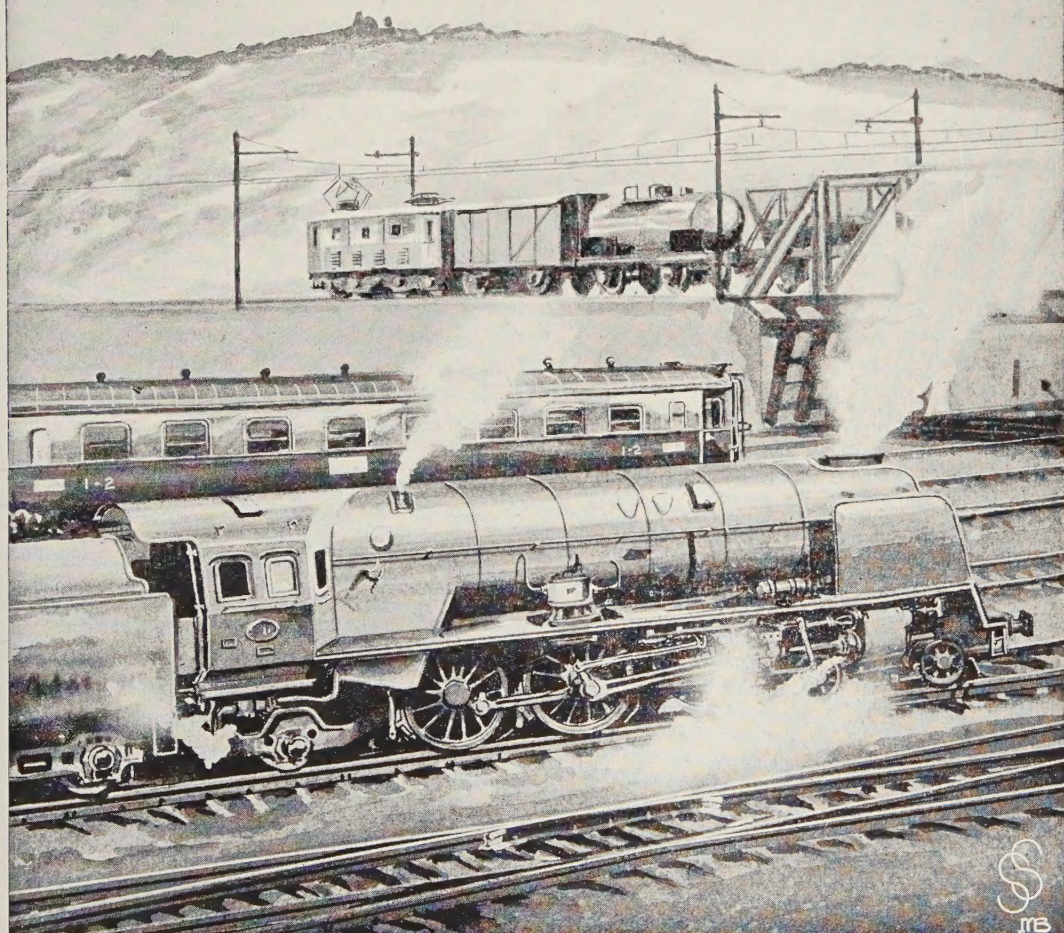


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MONTHLY BULLETIN

OF THE

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An edition in French is also published.

BULLETIN
OF THE
INTERNATIONAL RAILWAY CONGRESS
ASSOCIATION
(ENGLISH EDITION)

[656 .212°.5]

INTERNATIONAL RAILWAY CONGRESS ASSOCIATION

15th. SESSION (ROME, 1950).

QUESTION VII.

Organizing methods to be used in large marshalling yards and terminals, to reduce to the minimum the cost per wagon shunted.

Determination of the staff and number of shunting engines needed;

Capacity and control of the efficiency of the marshalling yards;

Recording and numbertaking arrangements in the arrival and departure yards;

Statistics and traffic analysis by the control-room;

Braking and retarding arrangements;

The formation of trains for departure.

REPORT

(Belgium and Colony, Denmark, France and Colonies, Luxemburg, Norway, Netherlands and Colonies, Poland, Switzerland and Syria).

by LAMARQUE,

Ingénieur en chef à la Région Nord de la Société Nationale des Chemins de fer français.

Different replies can be made to this question according to the type or nature of the installations at the different yards examined. The Administrations consulted were therefore asked only to include, at least in principle, the large yards equipped in an up to date way; consequently we will only deal with such yards, apart from a few exceptional cases.

In speaking of the cost per wagon shunt-

ed, the question also covers all the economies which it is possible to make under any heading in a marshalling yard. Anything that improves the general efficiency of the yard and its services, even if it is not possible, as is usually the case, to estimate the actual economy obtained, reduces the cost per wagon shunted and consequently comes within the scope of this report. The report also covers all the mea-

asures likely to improve in one way or another the output of the yard.

It goes without saying on the other hand that the quality of the work must not be overlooked, and the methods suggested or described intended to make economies must never lead to any slackness in the way the work is done. It is easy to make economies at the expense of the quality of the work: it is much harder to make them whilst maintaining or even improving the quality of the work. This is however the object which the Railway must strive after in every country; the idea of « output » will not be divorced from that of « quality » in this report.

Finally, as the question makes clear, only the methods of organisation or of working are covered, the equipment being taken for granted. The present report therefore is not concerned with the equipment of marshalling yards, which is more-over the subject of Question III of the present Congress; it merely refers to the type of equipment concerned as necessary.

The questionnaire sent to the different Administrations consisted of 41 questions under 9 separate headings. We have followed the same order as regards the nine headings, but have sometimes grouped together some of the questions in each or changed the order, to avoid too much referring back and too many repetitions.

The 9 headings in question were :

- I. General measures likely to improve the output of marshalling yards. Results obtained.
- II. Control and general supervision of the work.
- III. Checking.
- IV. Inspecting and repairing wagons.
- V. Shunting.
- VI. Braking and skid braking.
- VII. Making up the trains.
- VIII. Shunting engines.
- IX. Economies to be made when the number of wagons to be dealt with is less than the full capacity of the yard.

CHAPTER I.

General measures likely to improve the output of marshalling yards. — Results obtained.

Before examining the main operations carried out in marshalling yards, it appears useful to group together in the first chapter details about a certain number of measures, both internal and external, likely to improve the general output of the yard.

We shall therefore examine in turn :

- the inscriptions on the wagon labels, intended to facilitate identifying them on arrival at the yard;
- notifying the composition of trains expected at the yard;
- selecting the hours of arrival and departure of the trains;
- the use made of the lines;
- harmonization of the different operations carried out in the yard;
- the system of paying the staff special premiums.

We shall then comment upon the choice of certain factors making it possible to compare the output of the different yards.

Special inscriptions on the wagon labels.

Do there exist in your marshalling instructions any arrangements which are designed to assist the staff (in particular by indications on wagon labels) in identifying the destination station and the siding into which the wagon requires to be shunted ? (Question n° 1.)

In Belgium and France, the ordinary wagon label, giving the name of the destination station, also includes a number or number and letter code marked as clearly as possible so that the staff of each marshalling yard who deal with the preliminary shunting operations can see at a glance to which line the wagon should be shunted. At each yard the staff concerned merely has to have some simple document,

a pocket book for example, giving the number of the line (or the name of the next yard on the journey) against each of the different numbers of code letters given in their natural order.

Each station to which wagons can be sent as their final destination is given a number or code letter, known as the reference number or code. Stations in the same geographical zone are generally given the same letter. These zones are generally decided in principle according to the conditions under which wagons arrive at the destination stations; in France an attempt has even been made, though not quite successfully, to give the same letter to all the stations served by the same goods train, which would be ideal for facilitating at the last marshalling yard the shunting of the wagons for the different goods trains.

A chart sent to all the consigning stations gives the number or code letters of all the destination stations, which the consigning station must clearly mark on the wagon labels if they are not already so printed.

This system makes it possible for the men responsible for identifying the trains on arrival at the marshalling yard, to see immediately which line each wagon should be shunted onto; it also greatly facilitates making up the trains. It makes it unnecessary for the men to have an extensive knowledge of geography. It is flexible, since it makes it possible to modify the routes very quickly by altering the documents at each marshalling yard, without having to touch the code numbers which should always remain the same, at least between two alterations in the service. If accidents make it necessary to divert the trains, the orders that have to be given are very simple; finally it facilitates advising the marshalling yard of the composition of the trains being sent in, when this notification is prescribed (Question n° 2).

Under all these headings, the system plays a valuable part in the proper output and good working of a marshalling yard. The only precaution that must be taken is to

make sure that the internal records of the yard are always brought up to date in case there is any alteration in the routing; moreover if a yard makes a mistake in the routing of a wagon, the next yard can always reroute it correctly.

The only risk of a wagon getting lost is if a wrong code number or letter should be erroneously marked on the label; experience shows that this type of mistake is very rare, and the possible risk negligible compared with the advantages of the method.

In Holland, the Railway has been divided into 20 groups each with a central station. In addition to the ordinary label, wagons are given a special label giving the name of the centre station. The system is therefore slightly different from that used in Belgium and France, but the principle is the same, and its application has proved successful on a Railway of this size.

In Denmark recently labels have been used with different coloured edges, so that the staff can see, even from some distance away, whether the wagons are loaded with express parcels, express full loads, livestock, fragile goods, etc.

Norway also makes use of labels of different colours, to facilitate the shunting of the wagons.

Notifying the composition of the trains.

Are arrangements made for advice to be given of the composition of trains before their arrival at the marshalling yards? If so, what are the general arrangements, and is it found that there are advantages in this practice? (Question n° 2.)

Of all the countries consulted, only Denmark reported that the marshalling yard was advised beforehand of the number of wagons on a train coming in, as well as the destination stations, the nature of the goods, the tonnage and the braking weight. No other country has made arrangements for a complete and detailed notification to be sent to the marshalling yards regarding

the composition of trains forwarded from the previous yard.

On the other hand most of the Administrations consulted give certain notifications of the loads and composition. Some countries, such as Belgium and Luxemburg, and sometimes Norway, notify rakes of wagons (i.e. groups of wagons to be sent on in the same direction), as soon as they reach a certain number; for example Belgium notifies rakes of more than 10 wagons, and the number, per destination, of registered wagons. Switzerland notifies important rakes on certain special through trains. In France the regulations vary according to circumstances and variations in the traffic.

Such notification is facilitated in countries using the code numbers and letters mentioned above; it is then very easy to advise a yard A sending a train to yard B of the composition of the rakes which this yard B is making up for the other yards C, D, E... The wording of the telegram sent by yard A to yard B is very simple in this case (train n° ... 12 wagons for C, 13 wagons for D, etc...).

It is obviously an advantage for a marshalling yard to know as long beforehand as possible the general make up of the traffic coming in, an advantage which is still greater when there are sudden rushes of traffic, as when a yard is forewarned in this way it has time to make certain necessary arrangements (increasing the number of shunting engines, clearing sidings, etc.). Notification of the composition, detailed in rakes, of the trains expected also makes it possible to :

- foresee in good time if any special trains will have to be run; in view of the time required to supply an additional locomotive, this means that the trains can be cleared quicker;
- select the reception sidings for the trains according to their size and their composition;
- decide the order in which the expected trains will be shunted together with those already in the yard so as

to speed up the departure of such a train.

If detailed notification of the composition of incoming trains can render appreciable services, it is obvious on the other hand that a large marshalling yard does not generally need to know the composition of all the trains coming in, but only of those of particular interest to it (rakes for long distance through trains, important occasional traffic, etc.).

Such notifications are regularly given between certain adjoining countries, such as through trains from Luxemburg to neighbouring countries.

Timetables.

How do you determine, in the general interests of yard working, the arrival and departure times of trains booked to serve the yard ? (Question n° 3.)

It is not possible to fix the times at which trains will arrive at and leave a marshalling yard exclusively as a function of the best output from these yards.

If output alone is to be considered, trains should arrive and leave at regular intervals throughout the hours at which the yard is open. But other more imperative considerations intervene.

First of all the need for rapid transport — which it must not be forgotten is the essential criterium of a goods service — involves certain obligations in selecting the times.

For example the times of the stopping trains and those serving adjoining yards (main local station, private sidings, harbour lines, etc.) depend upon the hours at which these places are open and the working hours at the loading and unloading points. Generally it is necessary for the stopping trains to leave the yards at the end of the night period and come in in the evening so as to be at the stations they are serving before and after the hours at which these stations are open; services to tranship-

ment lines, sidings or quays must normally take place at night, so as not to interfere with loading and unloading.

The through trains must leave the marshalling yard after the stopping and local trains have been shunted, i.e. at the end of the night or early in the morning; inversely, the through trains must arrive during the afternoon or early evening.

However in the case of a train going to another marshalling yard serving more or less exclusively the stations in its sphere, the departure time should be so fixed that the train will arrive at its destination at the end of the evening, so that the wagons can be included in the next morning goods trains.

In the case of a train to another large transit marshalling yard, the time wagons remain in the two yards must be reduced to the minimum, taking into account the capacity of the destination marshalling yard.

Finally if there is only one train every 24 hours in a given direction, the departure time must be so chosen that the train can be made up after the trains bringing in the greatest number of wagons for this direction have been shunted.

On the other hand goods trains can only be run on busy passenger lines during certain periods of the day; they cannot be sent in particular immediately behind express trains or mail trains. In practice certain times are forbidden them.

Moreover the time which may suit one marshalling yard may not suit adjoining yards, the times taken by the trains between the two yards depending upon the distance, and the same yard receiving trains from the other yards various distances away.

Proper user of the locomotives also affects the choice of some times.

Finally, when several trains a day are needed for a given run, they must be so spaced throughout the 24 hours as to equalize as much as possible the tonnage cleared by each train.

It soon becomes obvious that most of these desiderata are incompatible, and consequently the only possible solution is a compromise between the different requirements.

Consequently a large up to date marshalling yard in which work must proceed a uniform rhythm if the output is to be satisfactory, must be equipped with one or several reception groups of sidings of sufficient capacity to cope with any irregularities in the arrival of trains, as well as one or more departure groups so that the shunting and making up groups can be cleared regularly, whatever the times at which these trains will eventually leave.

This does not mean however that nothing can be done in this respect, and that the output of the yard must not be considered when deciding the hours, especially when there is a shortage of reception and departure sidings.

Generally speaking the trains must not be timed in such a way that on arrival there is no room for them on the reception sidings, nor must they have to wait too long to leave, thereby hindering the work of the yard.

Everything must be done to divide the arrivals and departures over the available hours as regularly as possible. Departures as far as possible must take place according to the way the trains are coming in, so as to reduce to a minimum the time the wagons remain in the yard; this is essential from the point of view of the transit time, but also is a very marked factor in obtaining a good output, by decreasing the number of wagons present in the yard at any one time.

The value of a timetable properly adapted to the working of the yard becomes manifest when some portion of the yard has to be closed during certain periods of the day owing to a reduction in the traffic or any other cause. In such cases, the trains must be so timed that all of them have been shunted before the yard closes and so that when it reopens the work can be restarted immediately.

In the case of certain railways of limited size, such as Holland, when the transit time for goods is of the order of 24 hours, work in the marshalling yards is necessarily concentrated during the night at fixed hours; the timetables must then take this fact into consideration.

Use made of the sidings.

How is the use to be made of the sidings in the marshalling yard determined (specialised or multiple, fixed or changeable—choice of the siding for a given direction)? (Question n° 5.)

a) Specialised or multiple use.

In large up to date marshalling yards where the number of shunting sidings is general sufficient, each siding is normally used for a definite purpose. Double *simultaneous* use of the same siding limited to certain working hours, makes it necessary to shunt the siding a second time before making up the corresponding trains; consequently properly speaking there are no multiple uses made of a single siding.

In France however, yards in which simultaneous making up is practiced, which will be dealt with later on in Chapter VII, wagons for different directions are shunted onto the same siding, but such wagons will be made up in the same order in the trains; this is a kind of multiple use in a quite special case.

Generally speaking, only a shortage of sidings or the fact that they are not long enough is the cause of multiple use being made of them.

b) Fixed or changeable use.

In principle, sidings are used for a fixed purpose. Certain large marshalling yards however sometimes set aside a few shunting sidings which can be used *alternatively* for different lots according to the conditions at the time and the orders given by those in charge of the yard.

In other cases, for example when a sid-

ing is full, or in case of accident, the wagons are shunted onto another siding, chosen in advance so that wagons shunted in this way can be collected again when wanted; in certain marshalling yards, in peak traffic periods, there are also a certain number of relief sidings which are regularly used for any surplus during certain parts of the day from the sidings normally used.

In practice the use of the sidings is not therefore altogether rigid; often, especially in the case of variations in the traffic, accidents, or delays, there is a certain latitude, which must be recognised, although it is not very desirable and spoils the general output of the yard.

In Holland where marshalling takes place principally by night in two distinct working phases (long distance trains - local trains), there is on the contrary everything to be said in favour of different uses being made of the sidings during the two phases, and several sidings are used for two distinct purposes in this way during the course of the night. In such cases, a change of use improves the output of the yard.

c) Choice of the use to be made of sidings.

Choosing the use to be made of the sidings has a considerable effect on the output of work; it must be based on the installations and the kind of traffic brought in by the different trains.

Consequently it is valuable to :

- choose the departure route of a train made up on the shunting group of sidings in such a way that the making up operations are simplified to the maximum extent, and the departure of the train interferes as little as possible with the shunting;
- use the longest sidings for rakes taken away by heavily loaded trains or empty wagons;
- use the best running lines for the empty wagons, viz. in general the centre lines of the group.

Generally speaking, the use to be made of a siding must correspond as far as possible to the average importance of the wagons to be taken off, the number per day, and the geographical position of the siding compared with the departure routes.

The problem is not always an easy one nor completely solved, as some of the conditions are incompatible. For example selecting the use which gives an approximately equal number of wagons on adjacent sidings, facilitates the work of the brakemen, but complicates that of the pointsmen in certain cases, and increases the risk of wagons getting on the wrong line or overtaking each other.

Experience goes to prove that however imperfect the solution finally adopted, a careful selection of the use to be made of the sidings has a very definite effect on the output of the yard. Definite differences in output have been reported when the use of the sidings has been altered; this is one of the points which brings out the skill and professional knowledge of the staff in charge of the yard, and should not be overlooked.

Co-ordination of the different operations carried out in the yard.

What organisation has been established to co-ordinate the various yard operations, i.e., reception, examination, checking, numbering, marshalling, testing of brakes and the clearance of wagons from adjacent works, goods depots, tranship sheds, etc. ? (Question n° 4.)

If the same trains came into a marshalling yard every day and always arrived on time, it would be very easy with careful planning to lay down the exact sequence of work : reception of the trains, inspection, marking off, shunting, making up, testing the brakes, the shunting of the adjoining workshops, etc., but unfortunately the work of a marshalling yard varies from day to day; extra trains are run, the regular trains are sometimes cut out or altered

owing to variations in the traffic, and delays also occur.

Such difficulties must not however cause the idea of a programme prepared in advance to be given up so that the staff have to organise the work as best they can at the last minute.

In Belgium the work of the gangs carrying out the preliminary operations before shunting and the actual shunting (reception, inspection, marking off, etc.) is so organised as to prevent any loss of time, and the work of the different gangs is shown on a harmonogram which indicates the exact time work must be started on a given train.

On the other hand the very diverse nature of the operations involved in making up the trains (collecting the wagons together, coupling up, grouping them if needs be, testing the brakes, and inspection before departure) has made it difficult to organise this work on the same lines. However recently an analysis of the different phases involved has been carried out and the S. N. C. B. is now trying out similar methods to those successfully used in the case of the shunting.

In France the preliminary working programme covering the theoretical plan for the shunting, making up and feeding the shops, is normally prepared whenever any alteration is made in the services. The man in charge of the yard can naturally modify this plan if there are any appreciable changes in the traffic or any delays.

In all the large marshalling yards, a special control post which will be dealt with at greater length in Chapter II under the charge of a foreman is responsible in fact for making the daily modifications required to the theoretical programme and for adapting it to the actual circumstances. In this way the control post co-ordinates the different operations by issuing orders concerning the reception sidings to be used for the different trains, the inspection and identification of wagons on arrival the order in which the trains are to be shunted, the making up and inspection before depar-

ture, the shunting of the adjoining work-shops etc. It is responsible for obtaining the best use of the shunting engines, which is followed very carefully.

In Holland, the preliminary working programme also includes a theoretical plan for shunting and making up; very few modifications have to be made to it, however, as the traffic is very stable, and the number of extra trains very small.

Generally speaking, in all the countries consulted, the staff, responsible for the work of the yard, do everything possible to obtain the greatest possible measure of co-ordination in the work; this is one of their main duties.

Output premiums.

Have you had experience of a bonus system of working for the staff engaged in marshalling yards? If so, what advantages are found to result therefrom? Set out briefly the basis on which the systems are established. (Question n° 6.)

Although fixed premiums are often paid, in the countries consulted, to the marshalling yard staff for special efforts asked of them, only the Belgian and French Railways have introduced premiums which vary according to the output.

In Belgium these premiums are based :

1) on the ratio between the number of wagons leaving the yard which have been shunted and the number of wagons which could be dealt with by the available equipment;

2) on the ratio between the possible hours of work of the shunting engines and their actual hours of work;

3) on the ratio between the possible working hours, and the hours actually worked;

4) on the percentage of damage attributable to the yard.

Graded staff receive the same premium as the men plus a certain coefficient according to grade; the yardmaster however does not get any premium.

In France an output premium has been given in all the marshalling yards since the 1st April 1947. It varies from day to day according to the daily output.

The premium is based on four elements, the first two being positive and the last two negative :

1) shunting output, obtained by the ratio between the number of wagons sent out during the day and the shunting engine hours;

2) output of the staff, given by the ratio between the number of wagons sent out during the day and the number of men hours involved;

3) damage to the stock, given by the ratio between the number of wagons damaged and the number of wagons dispatched.

4) regularity of the services, obtained by the ratio between the total number of minutes of delay in sending out the trains for which the yard is responsible and the number of trains sent out.

Each of these four elements is given a variable coefficient for each yard, calculated according to the results obtained in practice by the yard before the premiums were introduced; in principle different coefficients are used for summer and winter. As stated above the last two elements are negative, i.e. they are ascertained from the results given by the first two elements.

The premium calculated in this way is posted up daily in the yard in the case of the lower grades of staff. Graded staff, including the yard master, receive the same amount plus a coefficient varying according to their grade; this reaches a maximum of between 5 and 6 in the case of the yard masters at the largest yards.

The premium can be reduced or withheld in individual cases for poor work or any fault committed by the employee.

The main difficulty with a system of this kind is to select the basic coefficients to be used for a given yard. The whole value of the premium in fact lies in these coeffi-

cients. The recent experience of the S. N. C. F. is that when the output is continuously being improved, it is difficult to decide upon these coefficients in the first instance, and they have to be modified after a while.

But once the coefficients have been correctly chosen, there is no doubt of the value of this system, and a definite improvement is obtained in the output or the quality of the work covered by the premium.

The Belgian Railways have found that it resulted in a marked decrease in the amount of damage occurring.

In France the quality and output of work have improved since premiums were introduced, and part of this improvement is undoubtedly due to the premium; the requests for additional labour have become much rarer, as thanks to the daily posting up of the premiums the men have been able to see for themselves the effect a shortage of men due to sickness or absenteeism has on the second element of the premium.

Premiums also make it possible for the managerial staff to explain to the men the results of poor work, and places where improvements are needed; for this reason they have a social and psychological value.

Results obtained.

In your large traffic yards, and under normal conditions of working, are any statistics recorded to show :

a) *the average time taken for a wagon to pass through the yard (with information as to how this calculation is arrived at) ?*

b) *the number of wagons shunted per shunting engine hour ?*

c) *the number of wagons shunted per hour of duty of staff employed, and is this broken down into the various grades, i.e.,*

— *pointsmen;*

— *numbertakers;*

— *staff engaged on braking wagons down, other shunting staff and supervisory staff ? (Question n° 7.)*

In measuring the output of marshalling yards, the factors generally taken into account are the average time wagons spend in the yard, the shunting engine hours, the number of men employed. We have collected together certain statistics relating to these points, and will try to draw some conclusions from them afterwards, though it is difficult to compare them.

a) *Average time wagons spend in the yard.*

In Belgium in the large marshalling yards with the most up to date equipment the average time wagons remain in the yard is about 13 hours.

This figure is obtained by taking the number of wagons in the yard at midnight and multiplying it by 24; the number of wagons leaving is then added, multiplied in each case by the hour of departure; the wagons arriving are then subtracted, multiplied by the hour of arrival. The total thus obtained is divided by the average between the number of wagons arriving and the number leaving.

In Denmark the average time wagons remain in the yard according to the fixed services in the train tables is $6 \frac{3}{4}$ hours.

In Holland, the position is altogether a special one. Owing to very serious competition, in a country of such small size, particularly competition from water transport, the Railways have had to apply the transit time « day A/day B » to nearly all their services. The large marshalling yards work mostly at night, in two successive phases; in the first, the yard makes up long distance trains with the wagons received during the evening from its zone; in the second, the yard makes up the stopping trains for its zone with the long distance wagons received from the middle of the night onwards.

Under these conditions, the average time spent by wagons in the yard is only about 5 hours; this figure is obtained by adding the number of wagons present at the beginning of each working hour and dividing

the total by the number of wagons dealt with.

In Switzerland, only counting the wagons passing over the hump, except for those sent on by passing trains, the average time in the case of the best equipped yards is about 5 hours. It should be made clear that generally these yards send out several trains during the 24 hour period in a given direction, and are often able to send a wagon for a distant destination for which there is no train for some time to a nearer destination on the same route.

In France the average time in the most up to date yards varies between 15 and 18 hours; it is less however in the yards where a fairly large number of trains are sent out on routes with several services during the 24 hour period.

This average time is calculated either by ascertaining the actual times in the case of different wagons by means of the arrival and departure documents, or by an approximate formula obtained by the division of the arithmetical average of the wagons coming in and leaving during the 24 hour period by the arithmetical number of wagons in the yard at the peak period and at the slackest period of the day; this latter method only involves two daily counts of the wagons.

b) *Number of wagons dealt per shunting engine hour.*

This number varies a lot according to whether one part of the yard is considered by itself, for example the shunting yard, and account made of the number of wagons dealt with therein, or whether the work in the yard as a whole is taken into account.

In Switzerland for example the average is said to be 72 wagons an hour in an up to date shunting yard with a hump; an average of 50 or 55 wagons in a making up yard, according to whether through or stopping goods trains are involved.

If the yard as a whole is taken into account, the number of wagons dealt with is appreciably lower.

In Belgium this number, which is about 20 an hour in yards where trains are made up in the standard way, reaches 30 or even 40 wagons an hour in certain marshalling yards near frontier stations or at the ports.

In Denmark, the average number is given as 22; it is 30 in Holland, and 35 to 45 in Luxemburg.

In France the results vary a great deal; the best equipped yards reach an output of 30 to 40 wagons, and even more in exceptional cases.

Generally speaking moreover, the output is definitely lower in the winter; it also depends to a great extent on the type of engines used, as we will see in Chapter VIII, and on the amount of making up that has to be done, as, all other things being equal, this involves the most work for the shunting engines.

c) *Ratio between the number of wagons dealt with and the numbers of certain categories of staff.*

It is absolutely impossible to compare the information collected on this point. Different working regulations, different classification of such and such groups of men within the categories of staff indicated, lack of information concerning the way the figures given were calculated, together with different operating conditions have resulted in figures which in practice have nothing in common. We will therefore omit them, in order to avoid any misunderstanding.

d) *General remarks.*

From the above it will be seen how hard it is to draw any conclusions from figures giving a general idea of the output of marshalling yards; the truth is that the idea of output cannot be conveyed by such means.

The average time spent by a wagon in the yard, in particular, depends not only on the quality of the work of the yard, but also even above all on the general programme for sending out the trains, which

has nothing to do with the working of the yard. If owing to this general programme, the wagons for a given direction only leave once in 24 hours, whilst wagons come in at regular intervals throughout the 24 hours, the average time they spend in the yard will include not only the time taken to carry out the actual work (which is the only time bearing upon the output of the yard) but an additional period of 12 hours whilst waiting to leave. If the wagons are sent out twice a day, this additional time is reduced from 12 to 6 hours, making a difference of 6 hours in the time spent in the yard according to whether there is one or two services in a given direction per 24 hours, which is a far from negligible difference.

A better criterion of the work of the yard is the time required to carry out the different operations, i.e. the time between the arrival of a wagon in the yard and the moment it could be dispatched if a train was due to leave. And here again, if this time it to be used to make valid comparisons between one marshalling yard and another, it must take into account the proportion of through trains without classification, and trains made up of multiple lots, arranged geographically as a rule, which have to be made up in the yard; as when there is a lot of making up to be done, the work of the yard is slowed down.

Taken as a whole, the time required for the actual work carried out in the yard seems to vary from 4 to 6 hours in a large up to date marshalling yard, according to the equipment and the relative proportion of trains that have to be made up in several lots.

The shunting engine hours also cannot be used to compare the output, unless the same operations are in question. Services to local yards in particular (depots, wagon repair shops, transshipment centres, private sidings, etc.) differ from one yard to another. If any such comparisons are to be made, it would appear advisable to exclude such local services, and merely consider the shunting engine hours used in shunting,

making up and getting ready to leave compared with the number of wagons arriving and leaving. Again, the results will be different according to the kind of equipment and type of engine used.

Finally it is impossible to compare the number of employees unless the working regulations are the same in each case, or unless, the numbers are brought into line with these regulations; finally if different working methods are used, it would seem wiser to limit the comparison to the number of wagons dealt with compared to the total number of employees.

CHAPTER II.

Control and general supervision of the work.

In this chapter we will deal in turn with :

- the duties of the special yard control post, when there is one;
- the adaptation of the yard's equipment to requirements;
- conditions under which extra or special trains are run;
- the control of the quality of the work and the general output of the yard.

Yard control posts.

Is there a control post or control agent at the yard and, if so, what are his duties so far as the marshalling yard is concerned ? (Question n° 8.)

In most of the countries consulted, the employees responsible for running the yard, or one of them specially nominated for this purpose, orders and co-ordinates the different operations carried out in the marshalling yard, without assistance from any special organisation.

In Belgium the yard foreman known as the « regulator » has a table before him showing the number of wagons present on each siding, which is brought up to date as the work is done by the markers off.

If the station is equipped with up to date installations, the duties of the regulator also cover the circulation of the trains on the outskirts of the yard, notification of the composition of the trains, as well as everything concerning the use of the locomotives. In addition, the large yards also keep a graph showing the user of the shunting engines.

In Holland the yard control post only regulates the train movements; supervision of the marshalling is the responsibility of the foreman.

In Switzerland the general yard control post is completed by a special marshalling yard control service.

In France there is a specialist organisation in the large marshalling yards known as the « central marshalling post » (P.C.T.).

This central marshalling post is connected by a direct telephone system with all the main parts of the yard, the signal boxes, etc. and is operated by an assistant yard foreman and one or two other employees.

He is responsible in particular for :

- regulating and following the reception and shunting of trains keeping the marshalling sidings clear, running the trains and engines within the yard, making up and dispatching trains, and serving the yards or sidings attached to the station;
- co-ordinating the different parts of the yard, in particular by distributing the shunting engines amongst them, regulating the number of men, etc.
- keeping a check on the utilisation and output of the shunting engines;
- adapting the size of the trains, especially the extra trains, to the traffic requirements;
- checking the way the empty stock is allocated and seeing that no delays occur in its turn round;

To sum up, his duties are the regulation and co-ordination of the work of the different parts of the yard as a whole.

To enable him to carry out this work, he usually has a blackboard on which the

number of wagons present on each reception and shunting siding is written up and corrected as the work proceeds (« stock table »); a graph showing the occupation of the sidings and the work of the shunting engines; a graph showing the running of the trains; a table giving the extra trains. By means of this information and the notifications he receives concerning the composition of the trains, the P. C. T. can see what extra trains will be required.

Naturally the P. C. T. is in contact with the organisation responsible for the train staff, the locomotive sheds, as well as the district office which in France decides what extra trains are to be run (see below, Question 10). He is also in contact with the rolling stock department responsible for the inspection and repairing of wagons; an interesting organisation for regulating the work of the inspectors, which will be described in Chapter IV (Question 16) has even been organised in some of the very large yards in combination with the P. C. T.

Although the P. C. T. installations cost a lot to run, on the whole they have led to an improvement in the output and quality of the work in the large marshalling yards; so long as they are limited to the very large yards, the cost of such installations definitely comes under the heading « paying », especially when the yard is divided up into many scattered parts.

Adaptation of the resources of the yard to actual requirements.

What arrangements are made to adjust the resources to the work required, and what arrangements are in force for providing analyses of traffic passing? What is the organisation which provides for the diversion of trains from one destination to another according to traffic fluctuations? (Questions 9 and 10.)

The constant adaptation of the methods used to the true requirements of the traffic is one of the most difficult problems for the Railway. The traffic does not vary

very much in some of the countries consulted (Norway, Holland). But if there is a lot of traffic, it is very rare not to have wide variations according to the period and circumstances; in such cases the idea of the output to be maintained becomes crucial.

If we limit the question to the work of the marshalling yard, we find :

- seasonal variations in the traffic, which can generally be foreseen in advance fairly accurately;
- periodical variations, generally weekly, there being some days with little traffic and others with relatively heavy traffic, which also can usually be anticipated;
- accidental variations which cannot be foreseen, some of which are temporary and others more durable;

The first two categories of variations do not give rise to too great difficulties since they can be foreseen. They can and must be taken into account in the train programme prepared by the traffic department as well as in the yard programme prepared by the yard foreman according to the train programme. In this way the working programme of the shunting engines is shortened on the less busy days, and part of the staff given their days off on these same days, etc.

The difficulty of maintaining the general output of the yard becomes manifest above all when there are accidental variations in the traffic. The first condition if this is to be maintained is very accurate information concerning these variations; the different countries consulted have taken different steps in this connection.

In Belgium the yards keep an account of the wagons, a double entry account of the different lots on the trains arriving and on the trains leaving.

In addition, the yard foreman receives every morning a report on the wagons in the yard, giving the number of wagons coming in, the number of wagons leaving, the stock in the yard at 6 a.m.; in this

report the number of wagons in the yard is shown under different headings : trains to be shunted, trains made up or being made up, wagons ready for local services, empty wagons which are not required, etc.

This information enables the yard foreman to take the necessary steps to correct any abnormal situations.

In Luxemburg the adaptation of resources to shunting requirements is obtained by the daily list of the loads of goods trains; these lists are checked by the head of the Secretariat who reports on them to the management. The Secretariat also decides what modifications must be made to the trains if there are any fluctuations in the traffic.

In France the yard master of course receives a daily report of the work of the yard. The district and traffic departments also are supplied with detailed information about the trains and two other documents :

- a daily statement of the work done in the yard the previous day;
- a weekly statement showing the number of wagons, and lots made up in the yard for the different routes.

The first makes it possible to assure that the resources of the yard (shunting engine hours, number of extra trains, etc.) are adjusted as far as possible according to the number of wagons dealt with.

The second makes it possible to study and prescribe the modifications in the service justified by any accidental changes in the traffic.

Variations of a temporary character are thus immediately detected by the districts which then make any changes in the working programme of the yard provided to meet such cases; if the traffic falls off, the practice is to close the yard at certain periods, or if this is not possible, to use any excess staff in such work as rectifying the loads, transhipment, cleaning, etc.

Variations of a lasting character are de-

tected during these examinations by the operating department which then modifies the train services in order to obtain as great an economy as possible in operation compatible with good train working.

Modifications to the train services generally include modifications in the lots of wagons to be sent to a given station, or modifications in the destination of certain trains. In Belgium and France, the orders issued for this purpose by the operating department are greatly facilitated by the use of the code figures or letters mentioned in Chapter I (Question 1).

If the lots have to be modified, the operating department merely has to change the list of numbers or letters for the rake intended for station A to those of station B; when the shunting staff at station A have noted the alteration, the making up of the new lots becomes automatic without any possibility of error. Alterations in the composition or destination of the trains are made in the same way.

When a train is likely to have its starting point or destination altered fairly frequently, for example owing to the arrival of many goods at the ports or frontier stations, or consignments from a large mining area, the fact is known in advance and the times of the extra trains, which may not always agree, are shown on the working timetables; the marshalling yard then merely has to select the most suitable, in agreement with the secretariat in countries where this organisation exists.

Running of extra or special trains.

What is the arrangement for setting up and despatching special trains as may be necessary to provide for the rapid and satisfactory clearance of the marshalling yard ?

In certain countries (Norway, Switzerland), the yard management itself decides when extra or special trains are to be run according to requirements.

In Belgium the running of these trains

is the responsibility of the regional dispatching department, whose duty, with the assistance of the regulator, it is to assure the rational user of the locomotives.

In Luxemburg, the running of extra or special trains is decided by the secretariat upon the request with justification from the making up yards.

In Holland the number of extra trains run is very small owing to the great steadiness of the traffic; the yard master asks the shed foreman to run an extra train, and at the same time advises the T. L. R. organisation which regulates the trains and locomotives from headquarters in each district. If the yard is full and special trains are needed to clear it, the T. L. R. has to authorise them.

In France the secretariat, a combination of the operating and traction departments, with offices at headquarters in each district, decides the conditions under which extra trains shall be run, taking into account the need to send the wagons forward as quickly as possible, the necessity to keep the yard clear, and the rational and economical use of the available engines.

The yards advise the secretariat of their requirements several times a day; the latter finds the best possible combination and lays down the route and engine to be used. This secretariat is only a part of the more general operating-traction department organisation known as the « control post » at the operating headquarters in each district; if the two departments fail to agree, it is understood that the « operating » has the final word.

In fact since the secretariat and the control posts were set up, disputes have been rare. This organisation has undoubtedly led to very appreciable economies in the use of the engines and traction staff, sometimes at the cost of a certain amount of inconvenience to the operating department.

When the yard itself decides to run an extra train, and requires a locomotive to be supplied at a given time, it obviously

cannot see the effects its demand will have on the proper use of the engines.

The setting up of the secretariat has to some extent rationalised the work of the yards and sheds, and consequently has led to a very appreciable improvement in the output for the service as a whole.

General control of the work of the yard.

What methods of control are exercised in order to ensure that the yard is operated with efficiency and economy ? (Question 11.)

The quality of the work and the general output of the yard is controlled in the first place on site, during the work, by means of visits of inspection along the sidings made as frequently as possible, either by the yard master and local supervisors, or by higher grade inspector.

This control on site is in particular a check upon the ratio between the stock and the number of wagons arriving and leaving, the time taken over shunting, abnormal shocks, excessive standing times, carrying out the allocation of the sidings and the classification of the trains to the regulations, delays to trains, the cleanliness of the lines, the proper use of the engines and staff, etc.

To facilitate this control, it is often laid down that the date and arrival train number shall be chalked up on the side of each wagon, so that the time it has been in the yard can be seen at a glance.

It is possible to complete this control in the yard itself by examining the different records or graphs that have to be kept; the daily list of waybills which remain in the yard until the wagon leaves reveals any abnormal delays. In France the different documents kept by the central marshalling post mentioned under Question n° 8, as well as the establishment of the factors on which the premiums are based (Chapter I - Question n° 6) facilitate effective and constant control of the use made of the shunting engines and labour, train delays, abnormal shocks, etc.

This control on site is completed by the check made of the documents by the higher grades of staff. Such documents obviously vary from country to country; they generally include factors making it possible for the higher grades of staff to check :

- whether the programmes of the routing and user of the trains are being adhered to;
- fluctuations in the traffic;
- train loads;
- delays to trains;
- the output of the shunting engines;
- the number of wagons damaged;
- the amounts of premiums if any;
- delays occurring in the normal work of the yard;
- the quality of the work of the yard (ratio between the number of wagons shunted and the wagons coming into the yard, for example, which makes it possible to determine how many wagons have gone over the hump more than once);
- etc.

CHAPTER III.

Marking off.

The question covered :

- the general organisation of the marking off;
- its possible reorganisation;
- the transport of commercial letters and documents within the yard.

General organisation of the marking off.

How is the marking off organised on arrival and departure ? What documents are used ? Do the marking off men prepare the shunting lists ? (Question n° 12.)

In all the countries consulted, the marking off is done on arrival, without exception, on the reception sidings, and on de-

parture on the making up or departure sidings.

In Belgium the marking off staff on the arrival of a train go to the guards van and collect the waybills. They are accompanied by an employee responsible for dividing the train, i.e. slacken out the screw couplings and uncouple the brake pipes. In large yards, the marker off himself prepares the shunting lists; sometimes however a special man is responsible for this work. In yards where lists are not used, the marker off chalks up on each wagon the number of the siding to which it is to be shunted.

The documents consist of the waybills for each consignment and a train list giving details about each wagon, as well as the code number of the stations on the way (see Question 1).

In Luxemburg the markers off receive a list of the wagons of which the train is composed from the guard, as often as possible at the van. They compare the waybills with the list, and issue supplementary lists for any other wagons without their papers. They check the load and fastenings of the wagons, report any irregularities found, label empty wagons to be sent to other yards as directed, mark the documents with the station date stamp, together with the number of the arrival and departure trains, and prepare the list for the trains leaving which they give to the guards.

In Switzerland all that is done on arrival is to check the waybills with the guard's list; the markers off do not prepare the shunting lists or mark the wagons with chalk (except wagons for local sidings). At departure, a list of the train is made on the spot and the corresponding documents prepared which the guard has to collect at the office; he then makes a more detailed list of his train.

In France the identification of trains on arrival generally takes place :

- on site, by the marker off who is given the documents and train list by the guard, and then checks the loads, pre-

pares the shunting list according to the code letters on each wagon label, and in certain yards at any rate, chalks up on each wagon the date and the number of the arriving train to facilitate checking how long the wagon remains in the yard;

- in the office, by the same man or another employee who compares the lists for each train with the waybills and prepares documents for each wagon without a waybill.

After this has been done the waybills are stamped and pigeonholed according to the destination of the wagons, in principle in a separate pigeon hole for each train route.

Identification of the train *on departure* is done by a marker off on site who has to make out a train list; he then compares his list with the waybills in the corresponding pigeon-hole, and hands them over to the guard, who in turn checks their accuracy.

It will be seen that in practice all the methods used are very similar. The main difference is found at departure, according to whether complete lists are prepared by the guard (Switzerland) or on the contrary by the marker off (Belgium, Luxemburg, France); the second method appears sufficient, and makes it possible to shorten the work of the guard before the train leaves.

Generally it is the markers off who prepare the shunting lists and mark the wagons with chalk where lists are not used; it appears best to take this responsibility away from the shunting staff, especially if the marker off has in any case to walk the whole length of the train.

Organisation of the work of marking off.

Is the work of the markers off detailed either by the organisation mentioned under Question n° 8, or in any other way? Advantages thereof. (Question 13.)

In Belgium the work of the markers off

on arrival is regulated by the harmonogram mentioned in connection with Question n° 4.

On departure they have to complete their work by the time fixed for the train to leave, taking into account the progress made in carrying out the necessary operations for making up the train.

If there is any delay, the chief clerk takes the necessary steps to regulate the work of his men.

In France the regulations are not always the same in all yards.

Sometimes the work is organised at the beginning of each working period, either by the rolling stock department to which the markers off are attached, in agreement with the central marshalling post (see question n° 8), or directly by the man in charge of the central marshalling post.

Sometimes the work of the markers off is prepared in advance in detail, in the case of the arrival and departure of regular trains; it can be modified according to circumstances (delays, extra trains, etc.). according to the instructions received from the central marshalling post. In principle therefore the work of the markers off is only regulated to the extent that the days work differs from the usual routine.

Finally in a few large yards there is a real organisation of the marking off. A member of the staff regulates the work of the pointsmen according to the conditions under which trains arrive or are made up: he prepares a graph showing the work done by each member of his staff, and organises the marking off operations according to the orders received from the central marshalling post.

In the other countries consulted, there is no organisation of the marking off.

It appears of value, particularly in the large yards, to organise marking off to some extent, in order to fit it in the best way into the general working of the yard.

This organisation can in most cases be limited to modifications to a regular programme or harmonogram prepared in ad-

vance, as it is an advantage when the man has to do approximately the same work every day; in addition during periods when the traffic is regular, the organisation of the marking off is simplified.

Complete organisation appears more attractive in the case of the very large yards; it does not appear as if the extra cost involved will be made good by sufficient improvement in the output of work from the markers off.

Transport of documents.

How are the documents and waybills travelling with the wagons transported in the yard ? (Question n° 14.)

The amount of documents and commercial papers to be transported in a marshalling yard varies according to the regulations in force in each country regarding such papers; only the documents accompanying the wagons have to be taken about the yard.

There is at least a double movement to be carried out : from the train on arrival to the office dealing with these papers, and from the office to the train on departure; sometimes the papers pass through two offices in turn, which means a triple movement.

The markers off, as we stated under Question 12 may be responsible for conveying part of the waybills they collect from the guard of the arriving train to the guard of the departing train. As it may happen that owing to trains being cut down or to delays, the marker off and the guard may miss each other, a box has sometimes been provided in the reception sidings in which the guard leaves or collects such documents.

In other cases the papers are generally conveyed by messengers or porters, on foot or by bicycle. In certain very extensive yards where the different parts are widely dispersed, there are mechanical means : small electric or petrol tramways, trucks, overhead lines, pneumatic tubes, etc.; in exceptional cases small staff trains are used.

CHAPTER IV.

Inspecting and repairing wagons.

Three questions will be dealt with here from the point of view of the Operating Department :

- where the work is done;
- possible organisation of the inspection work;
- special sidings for small repairs.

Where the inspection takes place.

How are the wagons inspected ? On what sidings is it usually done (reception, making up, departure) ? What is the average proportion of wagons marked off on the reception sidings on the one hand, and on the marshalling or making up sidings on the other ? In your opinion what is the best method ? (Question n° 15.)

In all the countries consulted, the wagons are inspected twice in the marshalling yard. The first time is upon arrival, on the reception sidings, before any shunting is done; the second time is before they leave, on the making up or departure sidings. In Holland, however, the average time wagons are in the yard is only 5 hours (see Question n° 7) so that inspection on arrival is only very cursory and is completed by the inspection on the making up sidings.

The value of a thorough inspection of each train on the reception sidings before shunting is unanimously agreed. When this is done, wagons needing repair can be shunted directly to the sidings reserved for this purpose, where repairs are carried out on site, or to the repair shops. If inspection only takes place after shunting, lengthy and complicated operations are involved to get hold of them. It appears that the additional cost of a complete and thorough inspection of the trains before shunting is largely made good by the improvement in the quality and output of the work resulting therefrom.

A second inspection is generally considered necessary before the departure of the train; this reveals any damage done while the wagon was in the yard as well as any that may have escaped notice the first time.

The ratio between the number of wagons that have to withdrawn on arrival compared with those withdrawn on departure varies considerably from one railway to another.

It is :

- 2.7 in Belgium, but the figures on which this report is based do not take into account wagons withdrawn for periodical overhaul operations (greasing and overhaul) or because they have been badly loaded;
- 15 in Luxemburg;
- 5 to 6 in France.

Regulation of the work of the inspectors if required.

Is the work of the inspectors controlled in every detail, either by the organisation considered under 8 or by any other method ? Advantages thereof. (Question n° 16.)

In most countries consulted, the work of the inspector is organised by the department to which they are attached by agreement with the management of the yard, but it is not controlled in every detail.

In Belgium the work of the inspectors on arrival is regulated by the harmonogram covering the shunting operations.

The work of the inspectors on departure depends on the making up of the train; their work is covered by the making up harmonogram now under trial.

In Luxemburg the work of the inspectors is regulated by a record graph fixing the work to be done as well as the zones and sidings where these operations are normally to be carried out.

In France the usual practice is for the

central marshalling post to give orders to the inspectors (see Question n° 8).

In general, as in the case of the markers off, the work can be planned beforehand in the case of the regular trains; whenever a change is made in the timetable, a graph shows the normal order for inspecting the trains and the time required in each case. The man in charge of the central marshalling post, with the assistance of the maintenance foreman responsible for the inspectors, makes any adjustments to this programme daily.

In a few large yards, this organisation has been carried further and a maintenance department man responsible for regulating and controlling the work of the inspectors in detail has been put in the central marshalling post and the train ing graph of each inspector according to the information he receives by telephone, and gives his orders to the different inspectors working in the yard by telephone from the central marshalling post.

The man in charge of the inspectors, who knows all the orders given by the central marshalling post and the train composition, is able to organise in a rational manner the work of the inspectors and the men in charge of small repairs when these are carried out on site; he is also able to advise the central marshalling post of any damage discovered before departure, which enables suitable action to be taken.

In this way there is as close as possible liaison between the man in charge of the central marshalling post and the man responsible for the inspectors, since they work together in the same place. This results in excellent co-ordination between the work of the yard and that of the inspectors. The operating department gets greater flexibility and speed with this organisation and is able to carry out its shunting programme with greater accuracy; the maintenance department improves the output of the inspectors.

Special sidings for small repairs.

Are there one or more sidings in the marshalling yard where small repairs to wagons can be carried out? Advantage of the method. (Question n° 17.)

All the countries consulted, with the exception of Luxemburg and Holland, set aside one or two lines in their large marshalling yards for small repairs to wagons.

In Belgium one of the marshalling sidings is generally reserved for damaged wagons. Wagons requiring small repairs are then transferred from this siding to a special repair siding, preferably outside the marshalling group of sidings, but easily accessible from the siding reserved for damaged wagons.

By this means, the staff responsible for small repairs is able to work in safety without having to take special safety precautions, which the Belgian Railways consider would impede the normal marshalling and making up operations.

In Denmark, two sidings in Fredericia yard are reserved for small repairs.

In Switzerland, sidings reserved for small repairs are often specially equipped for this purpose (gantries, etc.).

In France in most of the large marshalling yards there are one or two sidings set apart for small repairs and adjustments to the loads. The sidings chosen are usually situated on one side of the shunting group but with direct connection to the shunting and making up humps. A wide space is left between the lines to facilitate the work of the staff and for safety reasons. The best arrangement, when there is enough room for two tracks, is to arrange them in a half moon with padlocked points at each end of the half moon, the keys of the padlocks being kept by the foreman of the repair gang. In this way it is possible to continue to shunt onto the first line while the gang is working on the second; when the wagons on the second line have been repaired, they are cleared via the making up hump; the gang then goes on to repair the wagons on the

first line, while shunting continues on the second line, and so on. In this way both the repair work and the shunting can continue without interruption.

A small shop or repair van is provided near the site.

The advantages of such arrangement are obvious :

- the yard shunts wagons seen to be in need of repair whilst on the reception sidings directly onto the repair sidings; the repairs are carried out promptly;
- when repaired the wagons are easily moved on and incorporated in the lots to which they belong; delays are thereby reduced;
- the loads are quickly adjusted, with a minimum loss of time;
- loss to goods can sometimes be checked, for example a leaky tank wagon;
- finally the repair shops are not cluttered up.

There must however be sufficient room available alongside the marshalling yard.

In the large yards where there is no such installation, « repair gangs » with a few tools sometimes repair any small defects reported by the inspectors as far as possible before the wagons are shunted.

CHAPTER V.

Shunting.

The work involved in shunting, which has always been considered the essential part of the work of a marshalling yard, has been the subject of many studies in every country. The rational organisation of shunting the trains was examined in particular at the Paris Session (1937) of the International Railway Congress Association (Question VIII) and it does not appear that any appreciable modifications have been made to the methods used since that date. We will not therefore deal with the problem as a whole but merely touch upon

one or two points, like the questionnaire, considering in turn :

- the preparatory work before shunting;
- the best methods of shunting and the struggle to prevent wasted time;
- the precautions to be taken to prevent wagons overtaking others, as well as shocks and derailments;
- the removal of damaged wagons or those on the wrong route;
- the case of wagons that have to be sent forward under special conditions.

We are considering in particular the case of yards equipped with humps which are becoming more and more generally the usual practice in large up to date marshalling yards.

Preparatory work.

How do you carry out the preparatory work before shunting ? (Question n° 18.)

The preparatory work before shunting normally includes :

- inspecting the trains when, as is generally the case, the examiners visit the trains on the reception sidings; the examiners mark the wagons to be sent to the repair shops or the special sidings for small repairs when there are any in the yard. In Belgium, they also test the brakes for tightness and operation;
- identification of the train by the marker off, who sometimes has an assistant. Generally the marker off also checks the loads. Often, as has been said, he is responsible for preparing the shunting list, writing out the notices or marking the number of the shunting siding on each wagon in chalk; sometimes he only marks certain wagons (empties, fragile, local, etc); but sometimes a shunter is responsible for this work;
- uncoupling the wagons according to the shunting plan. This uncoupling

is done by one or two men who also disconnect the brake pipes and empty the compressed air brake cylinders. When a hump is used for the shunting, this work sometimes involves the complete separation of the wagons or rakes from each other and at other times merely unscrewing the couplings; in the latter case, a shunter specially stationed near the top of the hump lifts the coupling off the hooks with a pole during shunting.

In some countries the preparatory operations also include marking off fragile and registered wagons with which special precautions must be taken during shunting, or which must be sent by a special route; the designation of the groups of wagons which must be specially accompanied by one or more men to work the hand brakes; the preparation of the braking sheets (Belgium) for the brakemen using the skids (see Question n° 26), etc.

It will be seen that as a whole the preparatory work before shunting is very similar from one country to another; the question does not appear to call for any special conclusions.

Best methods of shunting.

In your opinion what are the best methods for assuring the best and most regular shunting ? (Question n° 19.)

Whether the best and most regular shunting is obtained depends upon the installations, the shunting engines used, and the organisation of the work in the yard.

Installations.

From the point of view of the installations the most important factors appear to be as follows :

- when a hump is used, careful selection of the profile so that there is a steep gradient at a short distance from the top, as this will cancel out as much as possible any difference in the running of the wagons; in yards

on a continuous slope, a sufficiently steep gradient in the reception sidings. Some countries claim that two humps of different heights, one for the summer and one for the winter are very useful;

- the adoption of symmetrical switches for the lead-ins to the marshalling sidings, which make it possible to shorten the area in which the track installations lie;
- the use of track brakes, which make it possible to equalise as much as possible the speed of the different wagons from the hump or on the continuous slope, which results in faster shunting without the risk of increasing damage;
- the adoption of a boat-shaped profile for the marshalling sidings, which favours the collecting together of the wagons whilst diminishing the risk of them overtaking one another, together with a hogbacked cross section which balances the resistances of the different routes.
- providing an efficient method of communication, both optical and acoustical, between the hump and the shunting engines on the one hand, and the pointsmen and brakemen on the other.

Naturally all these conditions must be fulfilled together, and the hump and sidings of the different parts of the yard must be so maintained that they always retain the best profile; the necessary maintenance operations must never be dispensed with.

Naturally the provision of relief or departure sidings, so arranging the lines that trains can leave and arrive without interrupting the shunting good visibility of the signal boxes, and rapid and if possible automatic operation of the points, will improve the output and regularity of shunting to a remarkable degree.

Shunting engines.

The type of shunting engine most suit-

able for the work of a marshalling yard is generally considered to be the electric locomotive on electrified lines, and the diesel locomotive on other lines. We will give various details concerning this subject in Chapter VIII; but we would like to mention here that the output of yards in which diesel locomotives have taken the place of steam locomotives has immediately increased to an appreciable extent; it is no exaggeration to say that the work of the yard has been completely transformed thereby.

In any case, whatever the type of engine used, it must be sufficiently powerful to push or haul the heaviest rakes.

Some yards use two shunting engines at the same time, the second working whilst the first is taking up its position at the end of a rake. This is one way of appreciably increasing the output (generally by about 25 % to 30 %); it may however prove expensive, as one of the two engines is always poorly used. This method must therefore be used with prudence.

Organisation of the work.

With a given type of installations and shunting engines, various steps must be taken to organise the work within the yard if the best shunting output is to be obtained.

First of all the speed at the hump must be carefully selected according to local conditions. In no case should this speed be excessive; it is often not necessary for it to be even fast; it must above all be as regular as possible. In each yard, it will depend upon the height of the hump, the way the lead in to the group of sidings fans out, the equipment of the signal box, atmospheric conditions, etc. It must be ensured by means of a trustworthy method of communication between the man at the hump and the driver; in addition to the usual type of signals, optical or acoustical, wireless has been used experimentally, particularly in France, and has proved satisfactory. In a large up to date yard, with automatic points, it appears that a rhythm

of 6 cuts a minute is the maximum practical, and it is rarely of value to exceed it.

The harmonogram or shunting programme should be correctly prepared and the work of the different men or gangs employed in the yard co-ordinated. The choice of the reception and departure sidings in particular depends upon this programme in order to avoid or reduce to the minimum interruptions to the shunting due to the running of the trains or rakes.

Train arrivals and departures should be spread out suitably to avoid overloading the reception or shunting sidings if there are no special sidings for trains waiting to leave (see Question n° 3).

The making up should also be carried out very regularly so that wagons are not being shunted onto lines already overloaded; this is one of the fundamentals which is not always properly appreciated by the management, who are hypnotised by the idea of speedy shunting.

Finally it is very important to have well trained drivers and motormen for the shunting engines in the large marshalling yards, and encourage them by output premiums where this is the practice. The training of the staff is always one of the main factors in obtaining a proper output of work, though this is often overlooked; the well trained employees for shunting, braking and driving the shunting engines will get a much higher output from the shunting than the others.

Avoiding wasted time.

How much time is lost during shunting for various reasons (wagons getting on the wrong line, wagons having to be pushed together on the marshalling sidings by the shunting engine, refuelling of the shunting engine, departure of a train which stops the shunting, etc.).

Ratio between time lost in this way and the total shunting time. What steps do you take to reduce such wasted time to the minimum ? (Question n° 21.)

How do you assure the wagons being in contact with each other on the marshalling

ing sidings ? Do you make use of tractors running on paths alongside the track to push the wagons, or what other methods do you use ? (Question n° 24.)

Systematic avoidance of wasted time, i.e. interruptions to the shunting, also lead to an appreciable improvement in the output of the yard.

Such interruptions to the shunting are mainly due to such factors as stopping to refuel the shunting engines, to let trains arrive and depart when this interferes with the shunting, and the need to push the wagons on the marshalling sidings up together, accidents to wagons or wagons overtaking each other, shunting damaged wagons or wagons that have gone astray, etc.

Their importance varies from one yard to another, according to the kind of installations, the type and number of shunting engines used.

In a large up to date marshalling yard, where the shunting is carried out by means of a single steam locomotive working at a time, the ratio of the interruptions to the total working time seems to vary in the countries consulted between 25 and 40 %.

Refuelling the shunting locomotive.

Interruptions for refuelling a steam shunting engine occupy a considerable time, often about 15 % of the total working time: it should be noted that this is one more factor in favour of the electric or diesel shunting engine.

In order to reduce this time to the minimum, the yards must be equipped with high capacity water cranes, auxiliary coaling plants, and ash pits, to avoid sending the engines back to the sheds.

In the case of very large yards, there is an extra engine for working whilst the others are refuelling; in this case the refuelling of several engines in turn should be spread out so that a single spare engine is sufficient to relieve each one of them.

When only one shunting engine is used, it is also preferable if the traction depart-

ment does not object, not to have a fixed hour for it to refuel, but to choose the most favourable time for this operation (departure of one or several trains interrupting the shunting, fewer trains arriving, etc.).

Secant lines.

Everything possible is done to avoid arriving and departing trains and movements between the different parts of the yard cutting across each other. When it is not possible to avoid one or several departing or arriving trains cutting across the shunting, as we said above, this is the time when the shunting engines should be refuelled, or supplementary operations carried out (pushing wagons together on sidings not affected, sending wagons to adjacent parts of the yard, assisting a train).

Pushing wagons together.

This should be done as far as possible by methods which will not interrupt the shunting.

The way the braking is carried out plays a great part. In particular braking to a stop at the end of the siding, which we will deal with in Chapter VI (Question n° 27), makes it possible in most cases to get the wagons bunched together when being shunted. This is obviously the best solution, especially when combined with the use of special wagon pinch bars which the brakemen can use when there is a gap in the work of braking. In certain Swiss yards, the brakemen are even forbidden to couple the wagons immediately, which makes it possible when necessary to move on the rake towards the making up sidings by means of an engine working on this side.

A second engine working on the shunting side is sometimes used to push the wagons up; but apart from interrupting the shunting, at least on a certain number of tracks, it is very difficult to synchronize the work of two or more engines in the same part of the yard, and the output generally suffers.

Certain countries have special locotrac-tors, electric capstans, or tractors working alongside the track for pushing the wagons together.

Norway reports satisfactory experience with petrol tractors, working alongside the track.

In Holland, a locotractor which remains on a dead end siding at the hump level during the shunting; pushes up the wagons as soon as the shunting engine has finished shunting them and moved on to the next rake; this method is fast and practical, but involves the additional cost of the locotractor.

In France electric capstans are used at one yard, and tractors working on paths beside the lines at a few others.

The use of electric capstans involves an electricity supply and costly installations.

The use of tractors requires sufficient room between the tracks (one out of two in principle) for them to pass; it involves appreciable costs for arranging the paths alongside the marshalling sidings and providing the necessary two or three crossings; finally special precautions must be taken so that in practice a second man is needed. The tractors used pull the wagons by means of a cable and do not push them; although it would be easy to design such a tractor working by means of an extending arm on the side for example which would only require one man, there would be a serious risk of accident every time he turned his back on the hum. As it is, the tractor worked by two men is a costly proposition, and consequently it would appear that its use cannot be recommended: furthermore it encourages the brakemen to be slack in carrying out their work.

Overtaking, shocks, derailments.

What precautions do you take to prevent overtaking, shocks, and derailments ? (Question n° 22.)

Overtaking.

The running characteristics of a wagon vary considerably according to its kind,

the type of axle boxes, the state of the greasing devices, the resistance on curves, atmospheric conditions, etc.

The cross section of the different marshalling sidings, as well as the height of the drop must be carefully studied from this point of view, as already indicated (Question n° 19).

As far as the organisation of the work of the yard is concerned, it is sometimes possible to select the user of the different sidings in such a way that the wagons can be separated nearer the top of the hump (see Question 5).

It is also very advisable never to exceed the shunting rhythm adapted to the practical resources of the installations provided. This rhythm moreover varies in a given marshalling group of sidings according to the prevailing atmospheric conditions.

Finally suitable *spaced* braking must be obtained, immediately after the hump, either by the use of track brakes or by skid brakes with avoiding devices.

The professional skill of the brakemen, if it is a case of track brakes or the spacing brakemen in the case of hand placed skids, is the decisive factor; when the men know their work, the wagons rarely catch each other up.

Shocks.

Shocks can be caused by a wagon stopping too soon if it runs badly, or unexpectedly running into the last wagon shunted on the marshalling sidings.

We have spoken about the precautions to be taken to prevent bad running wagons catching up with each other.

Shocks between wagons already shunted can only be avoided by very clever braking. This depends on the professional skill of the brakemen, which we will not go into again, and the braking methods employed. These methods will be considered in detail in Chapter VI (Questions 25 and 27); here we will merely state that the method of braking to a stop at the end of the siding,

endeavouring to bring each wagon right up to the former one without hitting it, seems to us the best way of reducing such shocks to the absolute minimum (Question 27).

Finally in every country special precautions are taken in the case of fragile wagons reported by the markers off when the train is identified on arrival. Some of these wagons are accompanied from one end to the other; others are shunted alone by the shunting engine or some other engine. Sometimes one or more special sidings are reserved for them. This is the case in particular in Belgium where wagons shunted onto these special sidings are protected from the other wagons by blocks which the 2nd or 3rd line brakemen put 50 m (164 feet) away; the same blocks are used on the ordinary sidings in the same way when there are no special sidings for fragile wagons.

Derailments.

Derailments at the lead into the group of sidings are generally due to premature working of the switches while the wagon is passing over them; to prevent them it is necessary to :

- ensure good visibility from the signal box;
- provide excellent lighting in the switch area by night;
- when the points are electrically operated, equip each switch with a safety circuit and make use of motors which reduce the time taken to operate the switch to the minimum (2/5th of a second in France).

Certain large yards have automatic signal boxes with track circuits which prevent the switches being operated too soon and thus remove any risk of derailment.

Finally precautions must be taken against the risk of derailments due to jumping or jamming of the skids or to the conditions of the track. Careful maintenance of the profile of the marshalling yard and the rails generally eliminates this.

Wagons that have gone astray or been damaged.

How do you take out wagons that have gone astray or been damaged or whose load needs adjustment ? What steps do you take to prevent wagons going astray ? What is the percentage of such wagons ? (Question 23.)

The regulations adopted for taking out such wagons from the marshalling sidings differ from yard to yard and railway to railway.

Sometimes they are put in their proper place by the making up yard, sometimes by the shunting yard; sometimes by one or other according to the position of the wagon, or depending upon who is responsible for the error.

Generally the work is done by the shunting engine, sometimes as soon as the shunting of the rake in which the wagon lies is finished; the wagons are then put onto the proper line, or in the case of damaged or badly loaded wagons sent to the sidings reserved for this purpose, when such sidings are provided.

On the other hand such wagons discovered after shunting on the marshalling sidings are often collected by the making up shunting engine.

It is difficult to decide which is the best method a priori. Whenever possible, so long as the number of such wagons is not too great, it seems better to send them to their proper place by the making up shunting engine; in this way the wagon concerned may miss the train it should have gone on, but any serious interruption to the shunting is avoided. If however it is necessary for the shunting engine to work in the group of sidings for other reasons (pushing wagons together for example), it may be better for it to collect one or several wagons that have gone astray at the same time. The method adopted should depend upon circumstances rather than upon a rigid principle.

The initial steps taken to prevent wagons going astray are first of all the same as those

intended to prevent them overtaking each other (Question n° 22), as if they do so, it nearly always means that one of them gets onto the wrong siding.

Other errors depend essentially upon the quality of the work : no mistakes in marking off, correct preparation of the cuts, regular rhythm of shunting and not at an excessive speed, skill of the pointsmen, brakemen, etc. Output premiums, when these are granted, can give very good results in this connection.

Everything must be done to bring the wagons together on the marshalling sidings as quickly as possible (Question n° 24), and to empty the sidings before they get full, either by ordering extra trains or by sending the wagons on to the special making up sidings if any. If these measures are insufficient or impossible, a provisional duplication of the siding which is filling up too fast (i.e. allocating a second siding for the same purpose for the time being) becomes necessary.

The percentage of wagons going astray compared with the number of wagons shunted generally lies between 1 and 2 %; some Administrations gave it as 1 % in the summer and 2 % in the winter.

Special routing.

Does your Administration make provision for the rapid transport of certain special wagons ? If so, how are these wagons dealt with in the marshalling yard; what effect does this have on the output of the yard ? (Question n° 20.)

In all the countries consulted, except France, there are special registered wagons which have to be transported faster and consequently treated differently in the marshalling yards.

Sometimes such wagons — placed as far as possible at the front or end of their train — are taken off before the train is shunted, either on the reception siding or on another siding; sometimes the train they belong to is given priority in shunt-

ing and the wagon is then directed (Belgium) onto a special siding for registered wagons, whence it can be taken and put at the front of the departure train for example.

In Denmark, the special arrangement of the yard at Fredericia makes it possible to send such wagons to the appropriate siding of the main marshalling group whence they can be rapidly sent to the making up group according to the station; the output if the yard is not appreciably affected by this.

In France, except in some absolutely exceptional cases, the special slow goods wagons which were run before the war have been done away with, and the marshalling yards do not have to deal with any wagons that require special treatment; this was made possible by the creation of another faster method of transport known as the « Speeded up regime » applied to certain kinds of goods which do not pass through the ordinary marshalling yards.

Obviously the special treatment of certain wagons imposes a great burden on the marshalling yards where it exists, and generally leads to an appreciable reduction in the output of the yard.

It was always fairly easy to estimate the cost in each particular case, and it always proved costly in the ordinary type of yard, and in addition involved delays prejudicial to the quality of the work in the case of the other operations.

The commercial considerations which demand special transport in certain cases must take this into account.

CHAPTER VI.

Braking and skid braking.

Throughout our report, though this is not the universal practice, we have used the word « freinage » (« braking ») for track brakes and mechanical equipment; the word « enrayage » (skid braking) refers to hand placed skids. The « freineur » therefore is the man responsible

for the mechanical brake equipment and the « enrayeur » the man using hand placed skids.

This chapter is divided into three parts :

— General braking and skid braking methods.

Braking to a stop at the end of the track;

— Scale of braking;

— Damage due to shock or derailment.

General braking and skid braking methods.

How do you brake the wagons :

a) *in the yards equipped with rail brakes?*

b) *in the other yards?*

In particular, how do you divide up your brakesmen in each case for the track brakes and skid brakes? (Question n° 25.)

In all up to date marshalling yards, there generally is :

— as near the hump or continuous slope as possible, brakes or skid brakes for *spacing* with the object of making the different wagons run at the same speed as quickly as possible;

— then brakes or skid brakes to *slow them down*, or skid brakes to *stop them*, or in some cases both.

a) *Yards equipped with track brakes.*

Of the countries consulted, only Holland, Switzerland and France reported that they use track brakes.

The track brakes are generally installed in the first three or four sections of the track, immediately below the hump, before the shunting group of sidings fan out.

Their essential object, as we have already stated, is to *space* the wagons, thereby correcting any difference in their running from whatever cause.

Yards equipped with track brakes generally only have a single line of skid brakes. These are sometimes merely used to slow the wagons down immediately after they

have passed the last switch; the skid is then removed after the wagons have travelled a certain distance by means of a gap in the rail. Sometimes the skids are used to *stop* the wagons (whether it has reached the end of the track or not) without a gap in the rail (Holland and Switzerland); the skid is removed by the brakesman after the wagon has stopped.

In certain yards, however, it has been considered advisable to retain two lines of skid brakes, one for slowing the wagons down, and the other for stopping them. It would seem that it is rarely essential to have one for slowing them down, since the track brakes can nearly always slow the wagons down sufficiently, in addition to spacing them correctly.

b) *Yards not equipped with track brakes.*

In large yards where there are no track brakes, spacing by means of skid brakes is generally assured as close as possible to the hump or continuous slope, by means of hand placed skids; the skids are automatically removed from the track when the wagon slows down by means of gaps in the rails. In certain cases however, the *spacing* braking is carried out by means of mechanical spring equipment which places a skid in front of the wagon at the required distance which is thrown clear at the end of the course; this equipment (Deloison, and Farenc types in France) is operated from a distance like track brakes.

Other countries also have automatic braking equipment on the inside of the sidings.

Slowing down braking, if any, and *braking to a stop* then take place in the same way as in yards equipped with track brakes.

Switzerland does not make use of braking for slowing down; in most of the yards where there are no track brakes there are two successive skid brakings to a stop.

c) *Number of men used.*

In Belgium, in the case of the *spacing* skid braking, one man is allowed for each

set of two groups of 8 to 10 sidings; two brakemen are therefore sufficient for the spacing braking in a yard with 32 to 40 sidings. If there are only 6 or 7 sidings in each group, 4 brakemen must be allowed for the total of 48 sidings.

In the second line (braking to *slow down* or *stop*), one man is allowed per 6 or 7 sidings, an average figure which has to be increased if the shunting takes place quickly, and can be decreased if there is a third line of braking.

In the third line, which is generally only used as an emergency, one brakeman is allowed per 12 sidings.

In Holland and Switzerland, the braking to a *stop* is done by one man per 3 or 4 sidings.

In France, in yards not equipped with track brakes, *spacing* braking is done by a total of 3 or 4 brakemen.

In all the yards there is one brakeman per 4 or 5 sidings for the *slowing down* braking.

Braking to a *stop* requires more or less men according to whether it takes place at the end of the siding or not; ordinary braking is done by one man per 4 or 5 sidings, like the slowing down braking; if it takes place at the end of the sidings, one man is required for each 2 or 3 sidings.

The figures relating to *slowing down* and braking to a *stop* do not refer to the total number of sidings in the group, but only to those on which shunting actually takes place.

All that we have said so far also applies to braking or skid braking during shunting; skid braking is also used in the same way, but generally simplified — slowing down, stop, or both — in the making up of trains.

Braking to a stop at the end of the siding.

In the use of hand operated skid brakes, do you work on the principle of bringing the wagon to rest short of the preceding

wagon in the siding so that the wagon may then move forward by gravity at such a speed as to bring it only very gently on to the preceding wagon? If so, how is this arranged? (Question n° 27.)

Braking to a stop at the end of the siding which, as we have already stated in Question n° 22, is intended to bring each wagon right up to the preceding one without any shock, is frequently used, especially in Belgium, Luxemburg, Switzerland and France.

If it is to be used under the best conditions, it requires :

- like all skid braking to a stop, a well designed type of skid, which can easily be removed as soon as the wagon has been brought to a standstill. The points of contact between the tyre of the wheel and the sole of the skid must lie along the sloping part of the latter; the wagon, assisted by the reaction occurring at the moment it stops, will then roll back a little and release the skid which is removed by the brakeman. Tests carried out in France, in particular, have resulted in types of skids, which, whilst not perfect in this regard, are much better than the old types;
- a very well designed longitudinal section of the marshalling sidings. These should be boat-shaped, with a gradual slope from the hump of about 2 to 2.5 mm per m (2 to 2,5 ‰); this is usually a sufficient gradient for the wagon brought to a standstill by the skid some yards away from the preceding wagon shunted onto the same siding, to run gently forward after the skid is removed right up to that wagon without any appreciable impact shock;
- skilful and well trained brakemen, as the braking length varies considerably according to the wagon and very great accuracy is required.

The brakemen are provided with a certain number of levers, poles or hooks, for

freeing the skids when they remain wedged after the wagon has stopped, and to assist them in moving wagons.

More are required than when the stop braking takes place at the lead-in to the group of sidings, as the brakemen are hampered by the wagons that have already been shunted onto adjoining sidings on which there are a different number of wagons, and consequently can only work on a reduced number of sidings than when they are working at the lead-in. In France, it may be remembered, it is considered that a brakeman at the end of the siding can deal with two or three sidings on which shunting is taking place.

Although rather more men are required, braking to a stop at the end of the siding, when used under the above conditions, is certainly the better solution from the point of view of shocks and damage. When it has taken the place of slowing down braking or the ordinary braking to a stop, it has immediately resulted in very appreciable reductions in the number of shocks and damage, and consequently the saving has been greater than the increased labour costs.

Calculating the braking.

In the case of braking by hand applied skids, do you depend upon the professional skill of your brakemen or do you tell them what amount of braking is required for each wagon (how)? (Question n° 26.)

In Belgium each of the yards equipped with « deviating rails » has a « braking reckoner » giving the length of braking for each zone, in terms of the different kinds of wagons (flat or covered wagons) and the percentage of the load on the first pair of wheels compared to the total weight of the rake. This reckoner is used by the men responsible for preparing a « braking bulletin » for each train to be shunted, a copy of which, or part thereof, is given to each brakeman concerned.

It is impossible however to take into account by this means the variation in many

factors due to atmospheric conditions, the running characteristics of the wagons, the condition of the rails, etc.; the brakemen therefore have to watch the wagons very closely in order to make any necessary adjustments in the braking distances given. Their professional skill is called upon therefore.

Reckoners of this kind have also been investigated and studied in France, but have gradually been given up.

In Denmark, only the braking length for fragile wagons are given to the brakemen.

In principle the Administrations consulted rely on the professional skill of the brakemen.

Many countries have endeavoured to give the staff useful information during the shunting, in particular by optical means (coded light signals) or acoustical (loud-speaker, telephone, trumpets, whistles, etc); in particular, heavy, fragile, accompanied wagons or those requiring special precautions, are generally specially notified.

In France an attempt has been made to advise the brakemen beforehand about the train to be shunted. For this purpose the head brakemen is given the train shunting list which shows the group of wagons, their weights, the sidings onto which they are to be shunted, as well as, if needs be, any fragile wagons. Before shunting starts, he has to collect his brakemen together, divide up the different sidings amongst them and give each one a brief description of the characteristics of the wagons or cuts with which he will have to deal.

The sidings are allocated bearing in mind the total number of cuts per siding, the time between them, the number of wagons already on the sidings, and the loads of certain wagons. During shunting, the chief brakeman can repeat the information given and announce by loud-speaker fragile cuts, accompanied cuts, or those badly braked by the track brakes; in this way the brakeman can modify the braking length previously decided upon.

Damage caused by shock or derailment.

What is your average percentage of wagons damaged in the yard owing to shocks or derailments? By what methods have you reduced this percentage? Is it lower in yards in which the method considered under question 27 above is applied? (Question n° 28.)

The average percentage of damage to wagons by shock or derailment compared with the number of wagons shunted in the large marshalling yards, given by the different Administrations consulted, is as follows :

Belgium : Percentage at Schaerbeek yard, which has the highest hump, without track brakes, and is consequently in the most unfavourable position : 2 per thousand.

Denmark : average percentage for the last five years : 0.33 per thousand.

Switzerland : 0.6 per thousand.

France : 0.4 to 0.5 per thousand.

These percentages cannot however be compared amongst themselves unless the definition of damage is exactly the same in each country, which is certainly not the case.

The methods which have made it possible to reduce these percentages — some countries have made very great progress in this respect since the end of the war — are many.

The working methods used have a lot to do with it. We have already reported (Question n° 27) the particularly good results given by braking to a stop at the ends of the sidings, and will not go into it again.

Care must also be taken in the professional training of the brakemen. From every point of view, including their pay, these men must be considered as skilled men, specialists in a difficult field, and not as mere labourers; they must be specially trained and supervised. Fines, or in Belgium and France, reductions in the premiums, for causing shocks, have been found of use where they have been applied; in

certain yards a braking notice is posted up showing the shocks caused by each man, which soon makes it easy to select the best men, as the job of brakeman requires special reflexes which every man does not have.

The total number of brakemen must always be at its full strength however many men are away on holiday or ill in the yard.

Regular maintenance of the lines, with which we have already dealt (Question n° 25) also has a very great influence on the braking results.

Finally it is essential to have some acoustical or at any rate optical means of communication on the site during shunting, between the brakemen and the pointsman or man generally responsible for the shunting. Up to date yards are generally equipped with loudspeakers and microphones for this purpose.

One method which has given excellent results in this case in many others, is to advise each marshalling yard every month of the results obtained in all the yards on the system. This information, together with a special campaign against damage, leads to competition between the different yards, which in a few months results in a very marked improvement. The human factor must never be overlooked by science.

CHAPTER VII.

Making up the trains.

Obtaining great efficiency in making up the trains is one of the most difficult tasks of a marshalling yard, as it comes up against the difficulty of making a rational analysis of a very varied job. Most of the countries consulted have however during recent years made a great deal of progress in this connection, as we will show, dealing in turn with :

- the general organisation of the making up;
- the repartition of work between the different marshalling sidings;

- the classical methods of making up;
- simultaneous making up;

whilst saying a few words in conclusion about the special problem of incorporating in the trains vans and wagons from the sidings near the yard.

General organisation of the making up of the trains.

How do you organise the making up of the trains? Do you prepare a working programme in this connection taking into account the order in which the trains arrive at the yard and the conditions under which they are shunted? (Question n° 29.)

The preparation of a preliminary making up programme will be viewed from a different aspect according to whether trains with multiple lots, semi-direct or stopping, and through train are in question.

Trains made up of multiple lots which in practice are always regular trains have a fixed timetable. Consequently it is possible and nearly always advisable to have a fairly rigid making up programme for these trains to make sure they will be ready at the prescribed hour. This programme is, in principle, independent of the conditions under which the trains arrive and are shunted.

The problem is more complicated in the case of the through trains.

Sometimes the working programme of the yard includes, as in the case of the shunting, a timetable for making up the different regular trains, or at least some of them; this programme is prepared by the yard master whenever the services are altered.

However such a programme is not the general rule amongst the Administrations consulted. The making up of the trains must take various factors into consideration. In particular :

- the shunting sidings must be cleared in good time to avoid having to use two sidings for the same purpose, and to facilitate the work of marshalling;

- rational use must be made of the shunting engines and the staff responsible for the making up;
- locomotives belonging to other sheds must be made use of as quickly as possible.

In countries where certain wagons are transported under special conditions as regards speed of transport, the need to ensure their rapid transit is added to the above requirements.

Belgium remarks that owing to the incompatibility of some of the conditions to be fulfilled, the rational use of the making up yard is sometimes sacrificed. However in certain yards of recent construction where the local services are of little importance and where the size of the installations makes it possible to be independent of the shunting rhythm, the making up of the trains can be organised on more rational lines, and can be regulated by means of a harmonogram similar to that used for the shunting. This method has recently been under trial.

Most often it is the necessity for clearing the shunting sidings to prevent two sidings having to be used for the same purpose which dictates the order in which the trains are made up, especially in yards where there is no special making up yard and where this has to be done at the other end of the shunting group of sidings to the hump. We have already explained the bad effects on the output of the yard of any interruption to the shunting, or even having to use two sidings for the same purpose unexpectedly.

This explains why it is difficult to fix *in advance* a complete programme for making up the through trains. On the other hand, such a programme can be prepared *each day* by the management of the yard — or by the marshalling control post if there is one — so that at the latest time at which the making up of a regular through train can be undertaken if it is to leave on time there are a sufficient number of wagons on the shunting sidings to make up the train to the prescribed length.

It goes without saying that in every case the making up must be done in sufficient time so that the train is not delayed.

The time taken varies considerably according to whether it is question of a multiple lot train or a through train to which only a van need be added after any wagons that have to removed have been taken off. It can also vary according to whether the yard is or is not equipped with light signals alongside the departure sidings between the two ends of the sidings for testing the brakes and fixed compressed air equipment, making it possible to carry out a complete test by means of fixed compressors before the arrival of the train locomotive.

Finally the making up must be done as quickly as possible so that the shunting is not held up and the yard is kept clear. Where difficulty is being experienced in this connection, special steps have to be taken as an urgent measure : relief shunting engine, or if it comes to the worst using the shunting engine to make up a few selected trains.

Distribution of the work between the different making up sidings.

When there are several making up yards, how is the work divided up amongst them and, if needs be, the marshaling yard? (Question n° 33.)

It is fairly rare to find several making up yards in the same marshalling yard, in the countries consulted. When there are, these are often double adjoining yards, each covering one direction of running; the division of the trains between them is then automatically controlled by their direction of running.

In France, however, a few yards with only a single shunting group of sidings have two making up groups. The distribution of the trains to be made up then depends either upon the direction of running of the train, or on the kind of train to be made up.

In the latter case, one group is usually

specially allocated for making up multiple lot trains, and the other for the making up and dispatching of the through trains. This method gives the best output from the installation and the locomotives.

The allocation plan of the shunting sidings, and the making up programme are then minutely studied in terms of the operating conditions, so that all favourable circumstances can be fully profited by. All details of organisation must be regulated according to the event.

The only general rule when there are several making up yards therefore appears to be the value of keeping them independent, either by allocating to each of them a definite part of the traffic, either according to the direction of running or according to the kind of trains to be made up. Exchanges of wagons between the different groups must be reduced to the strict minimum or suppressed altogether if possible.

Classical making up methods.

To obtain the best possible output in making up the trains do you depend upon the professional skill of the men or do you require them to work to an established plan? If so, describe it. (Question n° 30.)

The methods vary according to whether making up takes place on the main shunting group of sidings, on the opposite side to the shunting hump, or on one or several separate groups of sidings, specially allocated to making up. As this latter case is not so frequent and the methods may differ according to the layout of the special groups of sidings, we will merely deal with the more general case and suppose that the making up is carried out on the main group of sidings in the yard, by means of a making up hump on the opposite side to the shunting hump.

Through trains or trains with only a small number of lots.

The making up of a through train without any grouping is a simple matter; it

is generally done on the shunting sidings itself and may include, in addition, apart from taking out unwanted wagons, wagons that have gone astray and wagons that are overloaded, adding a brake-van and a few more wagons.

The making up of a train of two or three lots is also simple, as it generally is limited to rearranging the different lots in the right order on a given siding, after removing unwanted and lost wagons and checking the load of the train.

France has reported a simplified method applied in some yards consisting of making up several trains consisting of two or even three or four lots at the same time, provided that these lots are not too large (1).

For example if three trains each of two lots have to be made up (lots n° 1 and lots n° 2), usually three sidings A, B and C will be used to shunt the wagons for three trains, plus a siding X known as the passage siding.



The three n° 1 lots will be shunted separately onto each of the sidings A, B and C;

(1) This in actual fact is a simplified application — owing to the small number of lots — of the so called simultaneous making up method reported later on.

the three n° 2 lots will be shunted together onto siding X. They are then collected from siding X (from either end) and shunted again onto the three sidings A, B and C, so that the three trains are each made up of two lots at the same time.

With $(n + 1)$ sidings, n trains can therefore be made up at the same time with two lots apiece, provided the so called siding is long enough to hold the second lots for each of these trains.

If there are not too many wagons, it is possible to get a three or four lot train by joining up two lines with each other.

This method has the advantage of being absolutely continuous and making it possible at all times to deal with all the wagons required, in particular for making up additional trains as long as possible in advance. It is particularly valuable when trying to concentrate in one large well equipped marshalling yard the shunting of a certain number of adjoining yards; the large yard reduces the work by making up some of the lots and the adjoining yards only have to deal with the final making up.

Multiple lot stopping trains.

The making up of the multiple lot stopping trains is the greatest problem.

The classical method is to shunt all the wagons for the same stopping train onto a single siding, clear this line from the making up side and arrange the different lots on the free sidings or lead-ins; the lots are then collected one by one and placed on the departure siding in the proper order generally geographically.

Good output makes it essential to reduce the number of times each lot is shunted to the strict minimum, which can be done by profiting by the favourable position in the shunted rake of certain lots compared with others.

Theoretical studies have been undertaken in certain countries in order to give the men responsible for making up the stopping trains according to the classical method precise details about the method to be fol-

lowed to reduce the number of shunts to the minimum, but do not appear to have resulted in many practical applications.

France however sometimes makes use of what is known as « notice board making up » in which a notice prepared in advance by a yard foreman gives details of the shunts to be made to the men responsible for the making up. By means of a simple graph, an example of which is given in Appendix I to the present Report, the notice shows the wagons which are already in their proper order in the train, and gives at the same time a possible making up plan; but this plan, although nearly always the most simple, it not necessarily the best. The system requires an exact count of the wagons on the shunting sidings; on the other hand it does not do away with, though it may lessen the number, wagons shunted from one siding to another which stretches out the making up operations in the classical method to a remarkable extent.

Generally speaking, most of the Administrations consulted reported that the details of the making up operations were left to the initiative of the men, some of whom become remarkably adept.

The drawbacks of the system are however unmistakable. Whatever the skill of the men, it is not a constant factor and differs from man to man. Moreover the stopping trains often have to be made up one after the other at short intervals, which makes the problem still greater.

This has led certain countries, such as Belgium and France, to make use of the simultaneous making up method.

Simultaneous making up.

Do you make use of the so-called « simultaneous making up » method allowing several trains to be made up at the same time, by grouping on the same siding the groups of wagons which will be included in the same order in each train ?

If so, when and what savings or advantages do you obtain thereby ? (Question n° 31.)

The object of simultaneous making up as its name implies is to make up several trains at the same time, consisting of as many lots as required. By means of the preparatory work carried out once for all, it is possible to reduce to the minimum the number of shunts needed for making up the trains, and in addition to limit them to the shunting and part shunting of the sidings; this means that the work can proceed very fast and results in a saving of time of about 50 % compared with the classical method. This method also is extremely accurate.

To describe it in a full would be a lengthy process and outside the scope of this report, especially as there are several variations of the method; a detailed description, both practical and theoretical, can be found in the March-April 1940 issue of the *Revue Générale des Chemins de fer*.

Here, we will merely sum up the underlying principle.

This is essentially to send from the reception sidings, *onto the same siding*, not, as with the classical method, the rakes for the same train, but all the cuts for all the trains to be made up which *will come in the same order* on these trains after they are made up.

For example, in the case we will consider, if 5 stopping trains each with a maximum of 7 lots are to be made up, in addition to the 5 sidings from which the trains will leave, (which can be reduced by one or two as we shall see later on), it is necessary to have three shunting sidings. The wagons belonging to lots n° 1, 3, 5 and 7 for each of the 5 trains are shunted in any order on the first of these, and lots n° 2 and 6 on the second, while lots 4 go on the third.

The three sidings on which the wagons have been shunted in this way are known as *sub-marshalling sidings*; they are then cleared one after the other on the making up side and shunted again strictly in the following order;

- from the first siding to the second and third sidings of the sub-marshalling sidings, as well as to the 5 departure sidings of the 5 trains;
- from the second siding to the third sub-marshalling siding as well as onto the five departure sidings of the 5 trains;
- from the third siding to the 5 departure sidings of the 5 trains.

Each sub-marshalling siding is thus shunted in strict order : first, second and third siding, either to the other sub-marshalling sidings which have not yet been shunted, or to the departure siding for the trains. After this shunting from the three sub-marshalling sidings, the operation is completed and the 5 trains are correctly arranged on their five departure sidings.

Such a result can only be obtained by a very careful arrangement of the wagons before the first shunting, on the different sub-marshalling sidings. The arrangement is explained to the markers off who have to prepare the train shunting lists on arrival, usually by means of a table which gives, beside the names of the stations served by the stopping trains to be made up, arranged in alphabetical order, the number of the corresponding sub-marshalling siding. The preparation of this table is the foundation of the preliminary organisation work, and is fairly difficult, but is done once for all, and it intended to reduce to the minimum the future marking up shunting.

Appendix n° 2 of the present Report gives details of the shunting required in a given case.

The number of *sub-marshalling sidings* required does not depend on the number of trains to be made up, but only on the maximum number of cuts to be grouped in each train; if n sidings are available, the maximum number L of cuts to be grouped in a train is given by the formula ($L = 2^n - 1$). Three sub-marshalling sidings consequently enable each train to be made up with 7 cuts; 4, with 15, etc.

The number of *departure sidings* moreover can be reduced, as we stated above,

by using some of the sub-marshalling sidings for departure sidings when they have been cleared; the first, in particular, can be used for this purpose in every case; the second, in most cases (see Appendix n° 2).

It will be seen that once the original shunting has been done, the making-up properly speaking is limited to the shunting from the sub-marshalling sidings, each of which is only shunted once. In particular this avoids any shunting of a rake from one siding to another, which is typical of the classical method of making up and is the main reason why it takes so long.

In the example given above of 5 trains made up of a maximum of 7 cuts per train, the classical making up method would take nearly 4 hours. The simultaneous making up method with three sub-marshalling sidings would only involve three shunts and would not take more than an hour and a half, since the shunting of a rake of 50 to 60 wagons, including the time taken for bringing the engine up to the hump and the time wasted between two successive shunts, would not exceed 30 minutes.

If the work has been well planned, the saving obtained is always at least 50 %:

The method requires a rather greater number of sidings than the classical method; but one or two additional sidings are nearly always sufficient in practice. With the classical method in making up trains on the lead-ins to the group of siding it was usually possible to work with the same number of sidings as there were trains to make up; in the simultaneous making up method, the number of sub-marshalling sidings required which cannot be used as departure sidings must be added to this number, i.e. one or two at the most, except in very exceptional cases.

The method also means that the departure hours of the trains made up together in this way will not be spread out too much, to include wagons arriving at the last minute; it is always possible, generally speaking, to make up the first group of trains before shunting the final sub-marshalling sidings, and this allows for greater flexibility in the departure hours.

There may be some difficulties at the beginning due to a certain lack of comprehension on the part of the staff, who think it artificial and do not always easily master the principle. These difficulties soon disappear if the men are given a very clear means of seeing immediately the details of the operations to be done. In this connection, in France excellent results have been obtained by chalking up on each wagon, as soon as it comes into a reception siding, the series of sidings on which it must be shunted; 15/19, for example, means that the wagon must first of all be shunted onto sub-siding; during the shunting it will pass onto siding 15; when the latter siding is shunted it will be sent to siding 19 from which the train will start and where it will be correctly classed.

For, as we stated above, though the same siding is only re-shunted once during the making up operations, a wagon may be shunted twice, as in the example just given, or even three times — though this is exceptional — before reaching its final position on the departure siding.

This method is standard practice only in France, with various variations.

In Belgium it has been used in a few yards. It was found to give a saving of 50 % in the time required for making up but came up against the psychological drawbacks in connection with the staff explained above.

French experience has proved that if certain precautions are taken, these psychological difficulties will soon disappear. There remains the considerable saving in the time spent on making up, together with the very appreciable reduction in the possibility of error found in the classical method.

Including vans and wagons from local sidings in the trains.

How do you attach vans and wagons from the local sidings to the trains being made up (transhipment, local, shops, etc.). (Question n.º 32.)

The inclusion of vans is regulated in more or less the same way in every country, in the case of both stopping and through trains.

When stopping trains are made up according to the classical method, the necessary number of vans are shunted onto the sidings used for these trains; they are then put in place during the making up.

When simultaneous making up is used, the vans are one of the elements covered by this method; it is only necessary to select the desired number on the reception sidings, mark them specially, and shunt them directly on to the sub-marshalling sidings.

Through trains generally only have a single van at the end.

When they have to leave the yard on the shunting side, a van is shunted to the end of the siding as soon as the siding has been completely cleared; or the shunting engine is used to place a van at the head of the train from one of the marshalling sidings reserved for vans.

When they have to leave the yard on the making up side, the van is generally shunted into place by the shunting engine.

In all up-to-date marshalling yards, one of the shunting sidings is used exclusively or in part for vans; this is essential if there is to be a good output.

The wagons from sidings attached to the yard (transhipment, local, shops, etc.) are nearly always shunted into place by a shunting engine — usually at certain hours laid down in the working programme — on the reception group of sidings and then shunted like the other wagons.

In a few special cases, however, such wagons can be included in the train by the making up shunting engine, for example in the case of sidings served directly by this engine or only accessible on the making up side.

Wagons from a parcels transhipment depot may also be placed directly at the head of a train by the train locomotive (Belgium); in the same way, in France, wagons

running under the speeded up regime which are not dealt with in the marshalling yard, when, exceptionally, they have to be sent on by an ordinary goods train, may be added to a train made up in the yard, either by the train locomotive, or by shunting engine, or the making up shunting engine.

CHAPTER VIII

Shunting engines.

We will deal with :

- the selection and the power of the shunting engines used;
- continuity of work during interruptions for refuelling;
- driving and train staff;
- possible use of train locomotives for shunting;
- planning and controlling the use of the engines in the yard.

Choice and power of the engines used.

How do you select and determine the power of the engines to be used ? Have you had occasion to compare the output of a diesel locomotive with that of a steam or electric locomotive of equal power ? (Question n° 34.)

The choice and power of the shunting engines to be used in the marshalling yards is generally determined in more or less every case by :

- the tonnage of the trains arriving as well as that of the rakes to be moved from an adjacent group of sidings or from one group to another;
- the profile of the hump gradient, and that of the marshalling and making up sidings.

As these two characteristics are fixed, the engines used must be powerful enough to push the heaviest rakes up the hump without reaching their limit of power and adhesion, so that the best speed for the optimum shunting rhythm can be maintained.

But it is also necessary to have :

- rapid starting and sufficient acceleration;
- powerful braking, which results from a large adhesive weight;
- good visibility, both fore and aft;
- easy handling and simple driving.

Reserves of water and fuel, on the other hand, can be relatively small.

These conditions have led the countries consulted to design special shunting engines, and make them undergo various tests, particularly as regards their power on gradients, acceleration, etc.

In France the type of steam shunting engine most widely used (050 TA) has a working power of 1015 HP and a tractive effort corresponding to 15 600 kg (34 392 lbs.); its adhesive weight is 87 tons. In the electrified marshalling yards, the types of electric shunting engine most widely used (CC 1001 to 1012) have a working power of 480 HP when shunting and a tractive effort corresponding to 13 500 kg (29 762 lbs.); their adhesive weight is 90 tons.

Amongst the countries consulted, only Belgium, Norway, Switzerland and France reported using or carrying out trials of diesel shunting engines; Holland carried out some satisfactory trials with a diesel-electric engine of about 330 HP with a weight of 50 tons, the output of which compared with that of a steam engine, appears to be about 7 to 5.

Belgium is using 4 diesel-electric engines of the Armstrong type with 6 coupled wheels, a power of 350 HP and a total weight in running order of 50 tons; as the steam engines used are of a higher horse power, it has not so far been possible to make comparative output tests.

The trials made in Switzerland of a diesel shunting engine showed that its output was better and its maintenance more economical.

France put a hundred Baldwin type diesel-electric shunting engines into use in

1948 and 1949, with 4 pairs of driving wheels. they are 660 HP and their weight in working order is 109 tons.

These engines were immediately seen to be better than the steam engines as regards output in shunting at equivalent power. Both starting and running are more rapid; the engine is much more flexible for driving; finally practically no time is lost for refuelling and cleaning the fire. All these factors have led to very appreciable savings, of the order of 1/3 in the shunting time as a whole; in specially favourable cases, the replacement of the steam engines by these engines in a large yard has reduced the daily engine hours from 167 to 104, for the same amount of work. If we add to this the fact that the hourly cost for the two types of engines, at the same period (January 1950) on the same basis are respectively 1 940 francs for the steam engine and 1 520 francs for the Baldwin type diesel, the full value of the diesel can be appreciated.

Interruptions for refuelling and continuity of working.

Do you take steps to see that work continues during refuelling of the engine, according to whether refuelling takes place in the yard or at the shed, and if so by what means? (Question n° 36.)

In practice this problem does not arise in the case of electric or diesel-electric shunting engines.

Electric engines can be used practically continuously; the inevitable times when work is stopped are used to inspect and grease them.

The diesel electric engines, used in France, return to the shed in principle :

- to refuel, every 5 or 6 days, when they are out of action for 2 to 3 hours;
- for maintenance, every 10 days, when they are out of action for 6 to 8 hours.

In other cases, the engine only goes back

to the shed every 8 days for a total period of 8 hours.

The position is quite different in the case of steam engines.

Generally the engines are watered on site with the special watering equipment provided for this purpose; for coal and attending to the fire they have to go back to the shed.

In Belgium in yards where a sufficient number of shunting engines are working at the same time, continuity of the work is assured when necessary; a relief locomotive then replaces in turn all the locomotives working in the yard so that they can go back to the shed to refuel.

In the other yards, the necessary breaks for the locomotives to return to the shed are included in the working programme; however, if the shed is too far away, a refuelling point is provided in the yard.

In Denmark refuelling of the shunting engines takes place in the yard itself; it is done if possible during breaks in the work and does not involve much delay; the daily cleaning of the engines is done in the shed; during periods of heavy traffic, the shed supplies a relief engine.

In Luxemburg, Holland and Switzerland, relief engines are also provided if necessary.

In France this is also done. Everything is done moreover to reduce the interruptions of work to the minimum, either by attending to the fires in the yard itself, or by keeping a small stock of coal near the place of work so that engines can be refuelled on the spot (the engines can also be watered on the spot).

Driving and train staff.

How many men are required to drive and travel with the three different types of engines mentioned above? (Question n° 35.)

In all the countries consulted, the electric and diesel electric shunting engines are driven by one man only,

Steam engines usually require two men. This is the case in Belgium, Denmark, Luxemburg, and Switzerland.

In Norway, sometimes only one man is used.

In Holland, the driving staff consists of one man by day, and two men by night.

The rule in France in principle is only to use one man, unless the shunting engine has to run over the main lines. There are some cases however when two men are used, for example if the profile of the track or the tonnage of the rakes makes it essential to have a second man.

Besides the driver, there is sometimes another man from the shunting gang, for example when the engine is running in the area of switches that are not distant controlled by a pointsman, or in the case of any exceptional shunting.

Using train locomotives for shunting.

To what extent do you use train locomotives to carry out any shunting in the marshalling yard? Advantages of so doing. (Question n° 37.)

It is not the standard practice in any of the countries consulted to use train locomotives for shunting in the large marshalling yards, even at the beginning or end of operations. The train locomotives are not suitable for shunting and it would not be economical to use them; the train drivers do not understand the special conditions of work in a marshalling yard; finally it is necessary to avoid the many interruptions that would be involved to change the engine or the men.

On the other hand, in certain particular cases, the train engine can with advantage be used for certain additional movements, either on the arrival of the train, or before it leaves. For example the train engine of a short train can be used on arrival to put it on the reception sidings together with some other train; this saves a reception siding and a shunt. The train locomotive can also take off a wagon before depar-

ture, or add or remove a rake or a van; it can also (Luxemburg) be used in place of the proper shunting engine whilst the latter is refuelling. Usually it is question of occasional use, for a small amount of shunting, which obviates having to use an additional shunting engine (Belgium).

Planning and controlling the use of the shunting engines.

How do you assure that the shunting engines are used to the best advantage? How do you control their use? (Question n° 38.)

A working programme prepared in advance generally regulates the use made of the shunting engines. This programme which can be prepared for each yard in the form of a theoretical graph showing the use of the engines, fixes the periods of work of the different engines in each part of the yard.

The programme can cover various hypotheses in advance, if there are variations in the traffic or work of the yard; in every case, when there are appreciable variations in the work of the yard, it must at once be adjusted to the new requirements.

The periods of work of the engines are as far as possible adapted to the times of work of the shunting staff; whenever possible breaks in the work must be made to coincide with the absence or rest periods of the staff.

The extension of the marshalling output premiums, when they are given, to the shunting engine drivers also appears likely to increase the output of the work.

The use of the engines can be measured by the number of wagons shunted per hour; these numbers which can differ appreciably from yard to yard with the same output, for local reasons, remain comparable within the yard itself (see question n° 7).

The proper utilisation of the engines requires constant control which can be done by the two departments, operating and traction.

The men in charge of the yard, as well as the higher grades of operating staff, have at their disposal comparative tables showing the number of wagons shunted per hour. Certain countries (Belgium and France in particular) also keep graphs at each yard showing the practical utilisation of each shunting engine, which have been found to be a particularly effective method of control, since the position can be seen at a glance; in France, as we have seen, the marshalling control post mentioned under Question n° 8 is responsible for keeping these graphs.

The yard management also often has recording equipment installed on the engines; an examination of these diagrams, showing the exact times the engine was working and standing idle, often make it possible to reorganise the service. It is also possible to keep a regular check on the way the results obtained are maintained.

The output obtained in the different yards can also be made the subject of further detailed investigations by the higher ranks of the staff every month; such a check makes it possible to undertake general reorganisation measures or steps at a given yard to reduce the total cost of the shunting engines.

CHAPTER IX

Savings to be made when the number of wagons dealt with falls below the capacity of a marshalling yard.

At all the periods, and in every country, the Railway experiences ups and downs in the traffic. Periods of high traffic encourage the construction of the installations judged necessary to give the public the services for which it is responsible; it is very serious matter when falls in the traffic make such installations redundant. In some countries there is even a fear that owing to the keen competition from which the railways suffer, as well as the effects of the economic transformations which are shaking the world, some of the Railway

installations will never again be used to full capacity as in the past.

When there is a falling off in the traffic, the large marshalling yards are very quickly affected, and it becomes very difficult to reduce the cost of these vast installations proportionately; a study of the steps to be taken to operate them as economically as possible then becomes of paramount importance. We will deal with three cases raised by the questionnaire :

- continuous falling off of traffic;
- a large and prolonged reduction in the traffic;
- a falling off on certain days every week.

Continuous falling off of the traffic.

When there is a continuous falling off of the traffic, what steps do you take to economise ?

Do you prefer to slow down the output or close down parts of the yard for a few hours daily ? Advantages and drawbacks of each method ? (Question n° 39.)

The steps taken by the different Administrations consulted when there is a continuous falling off of the traffic vary in detail according to local circumstances, but are generally based upon the same principles.

In Belgium a slowing down or the closing of certain parts of the yard for a period or half-period of work are both used, according to circumstances.

In certain yards, particularly those where two shunting engines are used, it is easier to slow down the output; this is generally the method preferred.

Other yards are so equipped that it is necessary to carry out some of the work in auxiliary yards; the closing down of these yards is naturally the first step taken when there is a continuous falling off of traffic.

In Denmark the necessary economies are made by slowing down the output; reduced traffic has not so far made it possible to

close down any part of the yard, even for a few hours.

Holland avoids any slowing down of the output at all costs, and when necessary endeavours to make economies by diverting the work of the small yards to the large marshalling yards.

Switzerland reduces the number of shunting engines and endeavours to increase the output, without however closing down any parts of the yard, even temporarily.

In France and Belgium, output is slowed down in particular when normally two shunting engines are used in the yard. If the traffic falls off, the first economy made is to do away with the second engine for one, two or even for three daily 8 hour periods of work into which the day is divided. The savings made by economising in the one engine are not very great, as the output will decrease by about 20 % (see Question n° 19), and the output of all the staff employed in the shunting will also decrease; it is therefore also necessary to try and cut down the number of men employed by the operating department.

In the special case in which two shunting engines are used for the making up, similar but less clearly defined conclusions can be reached; especially as the arrangement of the sidings and the kind of work in the making up yards differ considerably from yard to yard.

In some cases in France slowing down the output is preferred, by reducing the number of men in the shunting gangs, or by borrowing from an adjoining yard, but such cases are rare when the yard is only equipped with a single shunting engine.

In the latter case, usually one or two parts of the yard are closed down for one or two periods of work.

If the arrival and departure of the trains is so organised that the work can be concentrated into certain periods of the day, the shunting and making up yards, or one of the two, are completely closed down for 8 hours, and sometimes even 16 hours, by adapting the working times to the optimum

marshalling and making up times for the trains. With this method it is possible to make considerable economies in labour, especially as no men need be on duty while the yard is closed down except for those dealing with train arrivals.

If on the other hand the traffic is spread out fairly evenly throughout the day, it is desirable to avoid completely closing down two of the main yards during the same period; the shunting and making up programmes can then be modified by using the same shunting engines for both operations, at least during certain periods of the day.

These partial closings down of the yards, however, which immediately result in appreciable savings, have the serious drawback of increasing the average time the wagons remain in the yard; however if such times are kept within reasonable limits and the train timetables revised at the same time, the delay will only be small. Moreover they lead to such a saving that it is essential to adopt them.

A large and prolonged fall in the traffic.

When there is a prolonged period of greatly reduced traffic, do you close down certain marshalling yards completely or in part? If so, on what factors do you base your decision, and how do you cope with the resulting changes? (Question n° 41.)

When there is a serious and prolonged reduction in the traffic, serious economies become necessary; several Administrations have tried to close down certain marshalling yards completely or to some extent, which nearly always involves a general reorganisation of the routing of trains.

A first difficulty then becomes apparent: the reduction in the number of wagons passing through the marshalling yards is not proportional, at least in a large country, to the falling off in the traffic. When there is a heavy reduction in the traffic, in effect, there are no longer sufficient wagons coming into the yard to make up a train

every day for several far off destinations; the trains therefore have to be amalgamated, and sent to nearer destinations, and services formerly run separately have to be combined. The number of halts for each wagon increases, which to some extent cancels out the effect of the reduction in the traffic as far as the number of wagons coming into a yard is concerned.

And so nearly everywhere it has been found practically impossible to close down the large marshalling yards completely, owing to the indispensable part they play in the general organisation of the routing even when this has been revised; however, some of the yards can be closed down for one or even two working periods during the day, as we stated above (Question n° 39).

On the other hand, it has been found possible to close down completely (and *a fortiori* partially) some marshalling yards of average size, by concentrating the work in the next nearest yard.

In such a case the best solution is to divert to the large neighbouring yard all the work to do with long or average distance through trains (wagons in transit) and retain in the secondary yard only the stopping trains for its district; the wagons for this district are then sent in together by the large yard which also receives all together the wagons from it for other destinations.

Sometimes it has been found possible to organise the making up of the district trains completely in the large yard, so that the secondary yard can be suppressed altogether; but this generally increases the train mileage.

In each case it is necessary to prepare a balance sheet showing the cost of labour, engines, train-kilometres, as well as the new transit times and new burdens imposed on the other yards.

The choice of the various possible solutions it then dictated by other considerations.

For example it is advantageous to get the maximum output from the installations

that cost the least to run, and these are not always the most up to date; unfortunately the yards and locomotive sheds equipped with these installations are not always the best situated geographically for the best routing programmes to be centred around them.

It can be appreciated that here again it is not possible to lay down a general rule; the solutions adopted will depend above all upon local or regional circumstances, the distance between the yards, and their possibilities, the new routing programmes, etc. This is a difficult problem which nearly always involves the preparation of new routing programmes and the revision of the work of most of the yards.

Reduced traffic on certain days of the week.

When there are only one or two slack days in the week (Sunday and Monday, for example) do you close down certain parts of the yard on these days, and if so, how? What kind of trains do you suppress? Advantages and drawbacks of the method used? (Question n° 40.)

The fact that there is little loading and unloading on Sundays leads to daily variations in the work of the marshalling yards; Mondays and Tuesdays are generally days with little traffic, while the traffic is very heavy at the end of the week.

The idea naturally will be to make a saving on one day of the week, and even, if possible, to keep the yards open six days a week with more or less uniform traffic, and close them down, at least partly, on the seventh day.

Nearly all the Administrations consulted have acted in this way, and taken various economy measures on account of the reduced traffic at the beginning or each week.

In Belgium the work of the marshalling yards between 10 p.m. on Saturday and 2 p.m. on Monday is adapted to the fact that certain trains are not run during this period.

Generally work stops completely between 6 a.m. on Sunday and 6 a.m. on Monday; Any Sunday work required in certain yards is merely to deal with the remaining wagons which the yard could not absorb owing to temporary difficulties.

Luxemburg organises limited shunting services on days with little traffic.

In Holland the work of the marshalling yards is stopped as a general rule from midday on Sunday till Monday morning; in principle no goods trains are run during this period.

In Switzerland the work of the marshalling yards generally stops from Sunday to Monday morning, with certain stages in the closing down of the different parts of the yard. Stopping trains do not run on Sundays, and only a small number of through trains run that day (7 to 8 % of the usual number).

In France, there have been partial measures to close down the yards every week in certain districts; they were made general under the name of « figeage » (« fixing ») during the summers of 1948 and 1949, and extended, in a lesser degree to the winter of 1949-1950.

At the beginning they consisted in principle in closing down all the parts of the yard for 24 hours, from Sunday morning to Monday morning; this period was chosen for the following reasons :

- there is no point in bringing into the destination stations on a Sunday morning wagons which will only be loaded or unloaded by the public on Monday morning; consequently it is natural to stop the local trains on Sunday;
- this stopping of the local trains on Sunday means arranging the period during which the yards are to be closed before the stopping trains leave on Monday;
- it is very desirable for all the yards to be closed at approximately the same times, to make sure that a wagon that has been held up in one will not be held up again in the next;

— it is best, wherever possible to make Sunday the weekly day of rest for the staff.

After having been applied for several months, the formula has been made less rigid. On the one hand, marshalling yards accepted and sent off certain trains during the period they were closed, which meant that on re-opening some of the reception sidings were occupied and some of the shunting sidings free; on the other hand, the period during which making up operations are stopped begins a few hours after shunting has stopped, to make sure in particular that wagons coming in and shunted on the night of Saturday-Sunday (the most heavily loaded period for arrivals) can be made up and leave the yard on Sunday for distant destinations.

Other combinations, varying according to local conditions at the yard, have also been used.

Naturally the stopping trains were also suppressed on Sundays, and some of the through trains on Sundays or Mondays.

The weekly closing of the marshalling yards leads to a great reduction in the costs. For example, during 1949 the S. N. C. F. was able to save 250 operating department men and 50 shunting engine drivers during the whole of the annual « figeage » period in the Nord Region, these numbers being calculated not only on the base of a day a week alone, but according to the time; it saved raising steam in 130 to 140 shunting engines for 24 hours every week, and led to appreciable reductions in the train-kilometres. However it has the drawback; of increasing the transit time, often quite appreciably; the times must therefore be arranged with a certain flexibility, taking into account the traffic requirements of the country or Administration in question. In a large country like France, a rigid weekly closing down for 24 hours once a week increases the average transit time by more than 25 %; the first modifications as indicated above reduced this increase to about 10 %; it may be possible to reduce it still

further without affecting the economies obtained too much.

Each Administration must therefore make a judicious compromise between its requirements as regards speedy transport (which is most often imperative on account of road and water competition) and its need to economise. The situation from this double point of view varies from one country to another.

SUMMARIES.

At the end of this far too lengthy report it is necessary to sum up very briefly the principal observations concerning the methods to be applied to run the large marshalling yards as economically as possible, without affecting the quality of their work.

Following the order of the questionnaire, we have come to the following conclusions :

coded figures or letters on the labels of wagons (at least in countries of a certain size); certain preliminary notification of the composition of trains; suitably timed hours of arrival and departure for the trains; careful allocation of the sidings : all greatly facilitate the work of marshalling yards and improve their output.

In the yard itself, harmonograms of detailed working programmes taking into account seasonal or periodical variations in the traffic which can be foreseen, must, each time the services are altered, define and co-ordinate the different operations carried out in the yard (reception, marking off, shunting, making up, shunting engines, etc). On the other hand, the concentration of all useful information in the hands of a foreman, sometimes going as far as to set up a real order and control post, makes it possible to harmonise the better all these efforts and is a far from negligible factor in obtaining a better general output.

Marking off and inspection, both on arrival and departure, are specially impor-

tant, and a careful check should be made to see that they are properly carried out, though the marking off at any rate cannot not minutely regulated. In particular the wagons must be carefully inspected on the actual reception sidings, so that the inspection before departure does not reveal any wagons that have to be taken out. Certain sidings of the shunting group can usefully be reserved for small repairs, together with the essential safety precautions involved.

A regular shunting speed, well adapted to the yard installations and atmospherical conditions, is of greater value than endeavouring to get the maximum speed possible.

The fight to prevent lost time and shunting incidents is of the greatest importance for the general output of the yard. In particular it is essential :

- to endeavour to reduce to the strict minimum interruptions to the shunting, particularly by special regulations concerning the refuelling of the shunting engine, pushing wagons up together, and reducing the number of wagons that go astray;
- to prevent wagons overtaking each other, and shocks and damage by appropriate braking and skid braking measures, the best solution being to space the wagons right from the start by means of track brakes and stop them at the end of the siding, just behind the preceding wagon shunted, by means of hand placed skids.

A general preliminary making up programme, although more difficult to prepare than the shunting programme, is extremely useful.

It is rarely desirable to leave the making up of trains consisting of multiple cuts to the complete initiative of the men; it is often valuable to prepare the work by means of notices, or better still, to adopt whenever possible the simultaneous making up method.

In non-electrified yards, the output of the diesel electric shunting engine is much

greater than that of a steam engine of comparable power, although the hourly cost is lower.

In all cases, a close control of the utilisation of the shunting engines and investigations into all measures capable of reducing interruption of the work result in valuable economies.

Should the traffic continue to fall off, the necessary economies may be obtained either by reducing the shunting output with a corresponding decrease in the labour employed, or by closing one or more parts of the yard during one of the three daily periods of work, or even during two in exceptional cases. If the reduction in traffic is prolonged and becomes more serious, the whole problem of the routing must be considered and the traffic re-allocated amongst the marshalling yards kept open.

A weekly falling off in the activity of marshalling yards at the beginning of the week may in general be followed up by important economies obtained by closing down the shunting and making up yards for a further 24 hours, the times of closing being staggered by a few hours. As this involves however an appreciable increase in the transit time, each Administration must make a judicious compromise between its requirements as regards rapid transport and its need to economise.

These different measures, however, no matter how interesting in themselves, do not cover all the aspects of the problem.

It must not be forgotten in the first place that the general organisation of the services and transport, as decreed by the management of the railway, will, as we indicated in passing, have a great effect on the work, and consequently on the costs of the marshalling yards. For an equal number of wagons, the work required of the yards may have an appreciable effect upon their expenses and consequently react upon the cost per wagon shunted. The departments which prepare the general transport programme must never forget this.

Moreover, if the rational organisation of the work has great advantages, two striking examples of which we have quoted when dealing with the general working programme and simultaneous making up, it must not be carried to such an extent that it risks taking away all flexibility from the service, and what is still more serious, kills the initiative of the men. There are limits to organisation which it is as well to remember, on the one hand because it leads to too great rigidity in the working of the service, and on the other hand because when the men become too accustomed to working automatically, they gradually lose the essential qualities of drive and efficiency and are helpless should anything unforeseen occur: such as any kind of accident, which is all too frequent on a railway.

Here we are up against a human problem which there is too great a tendency everywhere to neglect or subordinate to the technical problems. Organisation is a good thing, and helps a man; but the man must be able to control it, remain its master and not become its slave.

This explains in particular the importance, whatever the system, and under every regime, of selecting and training the staff, improving their working conditions, pay, and management. Whatever the organisation, a badly managed yard will function badly; a well managed yard will function better; very often just a change of management will effect in a few weeks what a purely technical reorganisation has proved powerless to do.

At every instant during our report we have come up against the human factor. Whether it is question of the shunting staff or the drivers of the shunting engines, the brakemen, or the staff responsible for making up, throughout the various grades we have seen the very great influence of the men upon the results obtained and the general output of the yard. On this note, which is well known but perhaps sometimes rather forgotten, we will end.

APPENDIX I.

Example of making up a train as posted by the classical method.

(Question No. 30.)

Let us suppose a train to be made up in the geographical order of the stations A, B, C, D, E, F, G, H, I, J.

Let us suppose that an inspection of the train, as standing on the shunting siding, gives the following results, starting from the making up hump : 3 E (i. e. 3 wagons for E) — 2 G — 1 H — 2 G — 2 A — 2 J — 1 H — 2 A — 4 B — 2 D — 5 E — 2 J.

There are therefore 4 wagons altogether for A (i. e. 4 A), 4 wagons for B (i. e. 4 B), etc. The train must be arranged in the order :

4 A — 4 B — 2 D — 8 E — 4 G — 2 H — 4 J

there being no wagons for C, E and I.

The following table is prepared showing in each column the different cuts of wagons in the order in which they are, and as ordinates the names of the destination stations arranged geographically.

Making up hump	3 E	2 G	1 H	2 G	2 A	2 J	1 H	2 A	4 B	2 D	5 E	2 J	
A					<u>2</u>			<u>2</u>					
B									<u>4</u>				
C													
D										<u>2</u>			
E	<u>3</u>										<u>5</u>		siding 1 A, B, D, E →
F													
G		<u>2</u>		<u>2</u>									
H			<u>1</u>				<u>1</u>						siding 2 E, G, H →
I													
J						<u>2</u>						<u>2</u>	siding 3 H, J →

To start with in line with each station in the column corresponding, the number of wagons in each lot is entered.

Starting from the top left hand corner and going downwards to the right, all the numbers encountered are underlined, and connected together by horizontal or vertical lines, *taking care not to go on to the next line until all the numbers on the same horizontal line have been accounted for.* The result is a sort of ladder representing the different lots which are already properly grouped in the train and which consequently can be shunted onto the same siding. When the right hand side of the table is reached, a second ladder is started, and so on.

In the example given, there are three such ladders, i. e. groups of wagons each of which can be shunted on to the same siding; siding 1 gets, in this order, lots E, D, B, A; siding 2 lots H, G, E; siding 3 lots J, H. The wagons from 2 are then shunted onto 3 and then those on 1 onto 3 and the train is made up (lots E and H will have been sent to two different sidings but will be shunted together again after siding 1 and 2 are cleared).

In this way the train is made up of 7 lots, using three sidings or lead-ins, with a single shunt and two setting backs. This way of making up however is not necessarily the best; in the example given, the train could be made up from two lead-ins, with two shunts and one setting back, which would take about the same time, but would save one siding.

APPENDIX II.

Example of the application of simultaneous making up.

(Shunting details.)

(Question No. 31.)

The example given in the text of the report (Chapter VII — question No. 31) deals with the simultaneous making up of 5 trains, A, B, C, D and E, each composed of a maximum of 7 lots (lots Nos. 1 to 7), these lots being numbered according to the order in which they should come when the train is made up.

We designate by (3_D) lots No. 3 of train D, by (6_B) lots No. 6 of train B, etc.; by (B) the whole of the (1_A), (1_B), (1_C), and (1_E) lots all mixed together; by (2) the whole of the (2_A), etc., lots mixed together, and so on.

Simultaneous making up in this case requires 3 sub-marshalling sidings *a, b, c* and, in addition 4 additional departure sidings (B, C, D and E) — (and not 5) — as the first sub-marshalling siding *a* can be used as a departure siding for one of the trains as soon as the wagons on it have been taken off to the making up hump to be shunted. Consequently 7 sidings at the most are need — usually only 6 (2) to make up and send out the 5 trains.

As we said in the report itself, the preliminary work of organisation will be to shunt :

- on siding *a* the *mixed* lots Nos. 1, 3, 5 and 7 of each of the 5 trains;
- on siding *b* the *mixed* lots Nos. 2 and 6 of each of the 5 trains;
- on siding *c* the *mixed* lots No. 4 of each of the 5 trains.

Before beginning to make up, the position on the sidings is shown diagrammatically in Fig. 1.

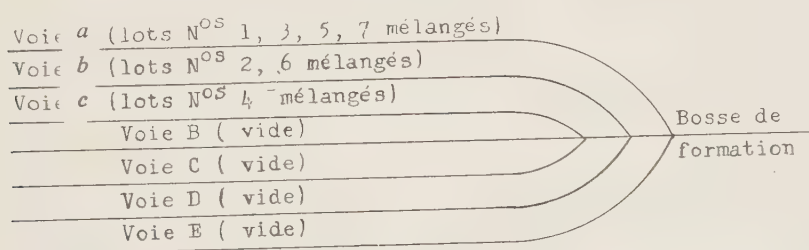


Fig. 1. — Position on the sidings before the making up operations begin.

Explanation of French terms. — Voie a (lots nos 1, 3, 5, 7 mélangés) = Siding a (lots Nos. 1, 3, 5, 7, all together). — Voie b (lots nos 2, 6 mélangés) = Siding b (lots Nos. 2 and 6 together). — Voie c (lots n° 4 (mélangés) = Siding c (lots No. 4 all together). — Voie B (vide) = Siding B (vacant). — Voie C (vide) = Siding C (vacant). — Voie D (vide) = Siding D (vacant). — Voie E (vide) = Siding E (vacant). — Bosse de formation = Making up hump.

(1) In many cases — when one train consists of 6 instead of 7 lots — the siding *b* can also be used as a departure siding which will reduce the number required to 6 (see the note at the end of the appendix).

First shunt (siding).

Siding *a* is vacated towards the making up hump and the wagons shunted onto sidings *b*, *c*, *a* (where train A will later be made up), B, C, D, and E in the following way :

- | | |
|-------------------------------------|---------------------------------|
| — Lot (1 _A) to siding A | |
| — Lot (1 _B) to siding B | All lots (3) to siding <i>b</i> |
| — Lot (1 _C) to siding C | All lots (5) to siding <i>c</i> |
| — Lot (1 _D) to siding D | All lots (7) to siding <i>b</i> |
| — Lot (1 _E) to siding E | |

The position of the sidings is then that shown in Fig. 2.

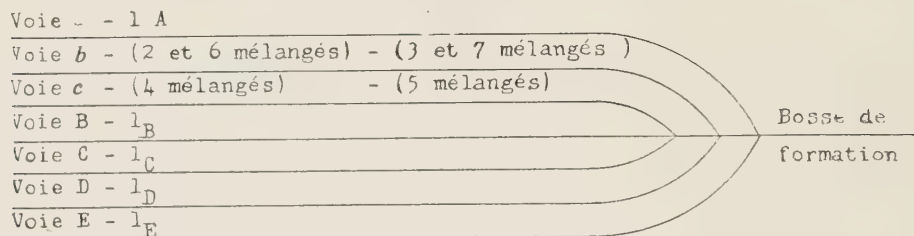


Fig. 2. — Position of the sidings after shunting siding.

Explanation of French terms. — Voie *a* — 1-A = Siding *a* — 1 A. — Voie *b* — (2 et 6 mélangés) — (3 et 7 mélangés) = Siding *b* — (2 and 6 together) — (3 and 7 together). — Voie *c* — (4 mélangés) — (5 mélangés) = Siding *c* (4 together) — (5 together). — Voie B — 1B = Siding B — 1B. — Voie C — 1C = Siding C — 1C. — Voie D — 1D = Siding D — 1D. — Voie E — 1E = Siding E — 1E.

Second shunt (siding b).

Siding *b* contains two different groups : at the end of the siding way from the hump are lots 2 and 6 together, and near the hump, lots 3 and 7 together.

This is cleared in its turn and shunted as follows :

1st part (lots 2 and 6 together).

- | | |
|---------------------------------------|--------------------|
| Lot 2 _A to siding <i>a</i> | |
| Lot 2 _B to siding B | Lots 6 to siding C |
| Lot 2 _C to siding C | |
| Lot 2 _D to siding D | |
| Lot 2 _E to siding E | |

2nd part (lots 3 and 7 together)

- | | |
|---------------------------------------|--------------------|
| Lot 3 _A to siding <i>a</i> | |
| Lot 3 _B to siding B | Lots 7 to siding C |
| Lot 3 _C to siding C | |
| Lot 3 _D to siding D | |
| Lot 3 _E to siding E | |

The position on the sidings is then that shown in Fig. 3 :

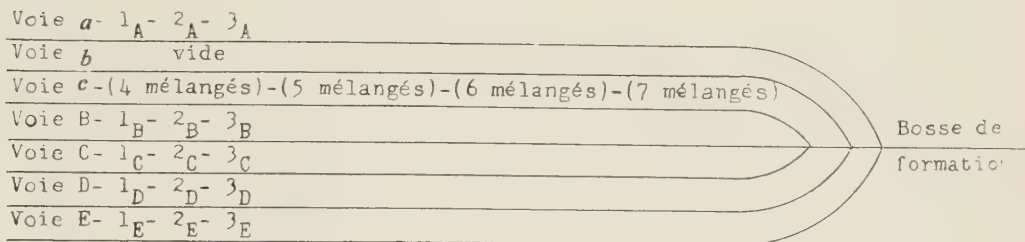


Fig. 3. — Position of the sidings after shunting siding.

Explanation of French terms. — Voie a — 1A — 2A — 3A = Siding a — 1A — 2A — 3A. — Voie b vide = Siding b vacant. — Voie c (4 mélangés) — (5 mélangés) — (6 mélangés) — (7 mélangés) = Siding c (4 together) — (5 together) — (6 together) — (7 together). — Voie B — 1B — 2B — 3B = Siding B — 1B — 2B — 3B. — Voie C — 1C — 2C — 3C = Siding C — 1C — 2C — 3C. — Voie D — 1D — 2D — 3D. = Siding D — 1D — 2D — 3D. — Voie E — 1E — 2E — 3E = Siding E — 1E — 2E — 3E. — Bosse de formation = Making up hump.

Third shunt (siding c).

Siding c contains 4 distinct groups of lots : 4 together, 5 together, 6 together and 7 together in this order.

It remains to shunt as follows :

- each of lots (4) to the corresponding sidings a, B, C, D and E (lot 4A to a — 4B to B — 4C to C — 4D to D and 4E to E);
- each of lots (5) to the corresponding siding a, B, C, D and E;
- each of lots (6) to the corresponding siding a, B, C, D and E;
- each of the lots (7) to the corresponding siding a, B, C, D and E.

for the five trains to be correctly made up on siding a, B, C, D and E, the two sidings b and c remaining vacant, as shown diagrammatically in Fig. 4 :

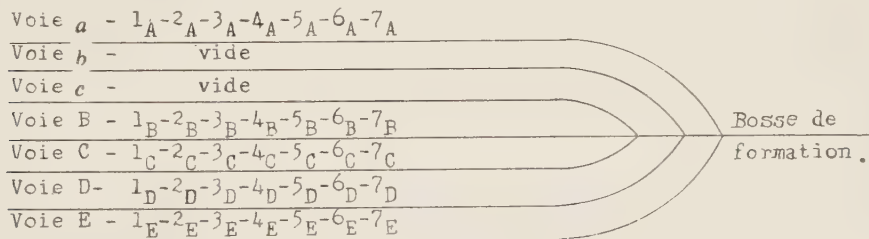


Fig. 4. — Position of the sidings after shunting siding c (making up completed).

Explanation of French terms. — Voie a — 1A — 2A — 4A — 4A — 5A — 6A — 7A = Siding a — 1A — 2A — 3A — 4A — 5A — 6A — 7A. — Voie b vide = Siding b vacant. — Voie c vide = Siding c vacant. — Voie B — 1B — 2B — 3B — 4B — 5B — 6B — 7B = Siding B — 1B — 2B — 3B — 4B — 5B — 6B — 7B. — Voie C — 1C — 2C — 3C — 4C — 5C — 6C — 7C. = Siding C — 1C — 2C — 3C — 4C — 5C — 6C — 7C. — Voie D — 1D — 2D — 3D — 4D — 5D — 6D — 7D. = Siding D — 1D — 2D — 3D — 4D — 5D — 6D — 7D. — Voie E — 1E — 2E — 3E — 4E — 5E — 6E — 7E = Siding E — 1E — 2E — 3E — 4E — 5E — 6E — 7E. — Bosse de formation = Making up hump.

N. B. — It will be seen that if one of the 5 trains — train B for example — consists of 6 instead of 7 lots, there would be no lot 1B and siding B would remain vacant after the first shunting of siding a (Fig. 2). Siding b consequently could be used as soon as it had been shunted as a departure siding for train B. Siding B would not be required, and the making up of the 5 trains could be done on 6 sidings, i. e. only one more than the number of trains to be made up.

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INTERNATIONAL RAILWAY CONGRESS ASSOCIATION

15th. SESSION (ROME, 1950).

QUESTION VI.

Comparative study of the different types of transmission between motors and axles of electric locomotives, electric motor coaches and Diesel-electric railcars. — Effect on the track of the types of bogies and systems of motor suspension.

REPORT

(Continued)

(America (North and South), Burma, China, Egypt, Great Britain and North Ireland, Dominions, Protectorates and Colonies, India, Iran, Iraq, Malay States and Pakistan),

by W. S. GRAFF-BAKER, B. Sc.,

Chief Mechanical Engineer (Railways), London Transport Executive.

Replies were received at a later date from:
British Railways (Midland Region) —
(Diesel-electric locos.).

British Railways (Eastern Region) —
(Part « C »).

The Great Indian Peninsular Railway.

The South African Railways.

The New Zealand Government Railways.

These replies covered additional vehicles of the following types :

- | | |
|--|-----|
| 1. Electric locomotives | 300 |
| 2. Diesel-electric locomotives | 4 |
| 3. Multiple unit electric motor cars | 332 |

1. Electric locomotives.

Electric locomotives are in use on all these railways, with the exception of the Midland Region of British Railways. Both axle-hung and frame-mounted motors are favoured, but the latter type is mainly confined to the Great Indian Peninsula Railway. The future policy of the South African Railways and the New Zealand Government Railways is to continue with the axle-hung nose-suspended motor but, while the former railway considers that a flexible drive is essential, the latter favours a rigid drive.

In general, there are no corrective devices in use to improve the riding of the bogies.

2. Diesel-electric locomotives.

The locomotives considered are too few in number and have been in service too short

a time to arrive at any definite conclusions as to their effect on the track.

3. Multiple unit electric motor cars.

Axle-hung nose-suspended traction motors are in universal use for this class of vehicle, and there seems no likelihood of departure from this type of drive in the future. Both flexible and rigid drives are used but it is not considered that there is any pronounced difference in their effect on the riding of the vehicle.

All bogies have swing bolsters but otherwise there are no devices fitted to stabilise and improve the riding of the bogies.

General.

Difficulties have been experienced on the South African Railways with electric locomotives, due to nosing and hunting of the bogies causing severe track wear and rail corrugation. It is considered that this is accentuated by regenerative braking and the use of articulated bogie locomotives.

Tests carried out on the South African Railways indicate that lateral forces on the track with electric locomotives are higher than with steam locomotives.

CONCLUSIONS.

It is generally agreed that wear on the track is greater with electric than with steam stock.

Most railways favour axle-hung motors on the score of simplicity but there is disagreement as to the need for a flexible drive.

2. Particulars of the gradients, curves and length of the lines over which the vehicles under consideration

ADMINISTRATION	
<i>British Railways (Midland Region).</i>	Maximum gradient. Minimum curvature. Longest run. Total route mileage.
<i>Great Indian Peninsula Railway.</i>	Maximum gradient. Minimum curvature. Longest run. Total route mileage.
<i>South African Railways.</i>	Maximum gradient. Minimum curvature. Longest run. Total route mileage.
<i>New Zealand Government Railways.</i>	Maximum gradient. Minimum curvature. Longest run. Total route mileage.

3. Loads and speeds in service for the various lines and different types of trains.

4. Gauge of the line.

5. In what year did you commence to put in regular service the vehicles concerned?

ADMINISTRATION	
<i>British Railways (Midland Region).</i>	Maximum load. Maximum speed. Gauge of line.
<i>Great Indian Peninsula Railway.</i>	Maximum load. Maximum speed. Gauge of line.
<i>South African Railways.</i>	Loads and speeds. Gauge of line.
<i>New Zealand Government Railways.</i>	Maximum load (passenger). (freight) Maximum speed (passenger). (freight). Gauge of line.

eral.

Type of vehicles		
Electric locomotives	Diesel electric locomotives	Multiple unit electric motor cars
	1 in 75 200 metres — 644 km	
1 in 37 175 metres 195 km 330 km		1 in 37 175 metres 122 km 207 km
1 in 41 115 metres 508 km 770 km		1 in 50 165 metres 56 km 240 km
1 in 40 200 metres 39 km 48 km		1 in 40 200 metres 39 km 63 km

Type of vehicles		
Electric locomotives	Diesel electric locomotives	Multiple unit electric motor cars
	450 000 — 550 000 kg. 121 km/h as double unit. 1 435 mm.	
Passenger 500 000 kg 105 km/h Freight 2 000 000 kg 57 km/h 1 675 mm		380.800 kg (8-car) 89 km/h 1 675 mm
See separate sheets 2A and 2B. 1 068 mm		1 068 mm
« Eo » 12 500 kg 40 km/h	« Ec » 350 000 kg 600 000 kg 81 km/h 48 km/h 1 068 mm	« Ed » 400 000 kg 500 000 kg 73 km/h 48 km/h
		9 400 per car 73 km/h 1 068 mm

ATTACHMENT TO
QUESTION 3.**Loads and speed in service for the various lines and different types of trains.**

Details of the speeds and loads for passenger, mixed and goods trains applicable to some of the more important main lines of the South African Railways, which can be regarded as typical sections as regards variation in grades, speeds and loads for the types of trains in question are as follows :

Section of line	Maximum speed	Types of trains	Loads applicable
Johannesburg-Cape Town.	55 m.p.h.	Passenger and goods trains conveying bogie stock only (certain types of bogies are restricted).	Passenger trains vary between 640 tons/64 axles and 696 tons/48 axles; goods trains between 726 tons/80 axles and 1 490 tons/90 axles.
Johannesburg-Cape Town.	35 m.p.h.	Mixed and goods trains conveying bogie and short vehicles.	Loads vary between 726 tons/80 axles and 1 490 tons/90 axles.

It should be mentioned that the maximum load over the Hex River Pass is 430 tons/46 axles for the mechanically stoked engine, and all trains consisting of loads in excess of this load are assisted (banked or double-headed) in which case the maximum loads is 774 tons/80 axles. In the case of hand-fired engines, the figures are 382/46 and 726/80 respectively.

Section of line	Maximum speed	Types of trains	Loads applicable
Port Elisabeth-De Aar.	55 m.p.h.	Passenger and goods trains conveying bogie stock only (certain types of bogies are restricted).	Passenger trains vary from 440 tons/44 axles to 600 tons/60 axles. Goods trains from 400 tons/60 axles to 1 150 tons/100 axles.
Port Elisabeth-De Aar.	35 m.p.h.	Mixed, and goods trains conveying bogie and short vehicles.	Vary between 400 tons/60 axles and 1 150 tons/100 axles.
Assisting of trains is undertaken over portions of this line.			
East London-Springfontein.	45 m.p.h.	Passenger and goods trains conveying bogie stock only. (Certain types of bogies are restricted).	Passenger trains vary from 360 tons 36 axles to 600 tons/60 axles. Goods trains between 320 tons/56 axles and 880 tons/60 axles.
East London-Springfontein.	35 m.p.h.	Mixed and goods trains conveying bogie and short vehicles.)	Vary between 320 tons/56 axles and 880 tons/60 axles.

Section of line	Maximum speed	Types of trains	Loads applicable
Trains are assisted over certain sections of this line.			
Durban-Volksrust.	55 m.p.h. for passenger trains and 45 m.p.h. in the case of goods trains	Passenger, and goods trains conveying bogie stock only (certain types of bogies are restricted).	Loads vary from 245 tons/24 axles for one E1 type, type electric unit to 570 tons/64 axles for two units, type 1E. Over the Boughton-Hilton Road section passenger trains consisting of more than 400 tons/40 axles require to be worked by 3 1E type electric locomotives.
Durban-Volksrust.	35 m.p.h.	Mixed, and goods trains, conveying bogie and short vehicles.	Vary from 400 tons/40 axles for one 1E electric unit to 1 650 tons/140 axles for 3 1E electric locomotives on steepest sections.
Volksrust-Johannesburg.	55 m.p.h.	Passenger trains.	Vary between 600 tons/60 axles to 640 tons/64 axles.
Volksrust-Johannesburg.	35 m.p.h.	Mixed and goods trains.	1 000 tons/96 axles.
Komitipoort-Pretoria.	55 m.p.h.	Passenger, and goods trains conveying bogie stock only (certain types of trucks are restricted).	Vary from 480 tons/48 axles to 640 tons/64 axles.
Komitaport-Pretoria.	35 m.p.h.	Mixed, and goods trains conveying bogie and short vehicles.	Vary between 640 tons/64 axles to 1 200 tons/110 axles.
Johannesburg-Pretoria.	60 m.p.h.	Motor coach trains only.	Approximately 400 tons/40 axles.
Johannesburg-Pretoria.	45 m.p.h.	Passenger trains hauled by electric units.	640 tons/64 axles.
Johannesburg-Pretoria.	55 m.p.h.	Steam passenger, and goods trains conveying bogie stock only. (Certain types of bogies are restricted.)	Vary between 520 tons/52 axles and 1 040 tons/80 axles.
Johannesburg-Pretoria.	35 m.p.h.	Mixed, and goods trains conveying bogie and short vehicles.	Vary from 770 tons/70 axles to 1 040 tons/80 axles.

It will be observed from the foregoing that the speeds and loads of trains vary considerably, even on a throughout section of the line, the difference being chiefly due to the variations in gradients.

The loads indicated are those hauled by the largest types of engine operating on the section quoted, except in the case of Natal where the larger type of unit 3E is confined to purely passenger-working, and the 1E type of lesser tractive effort, utilised for the haulage of passenger and goods trains.

6. Principal characteristics of the vehicles considered.

QUESTION		British Railways (Midland Region)
		Diesel electric locomotives
1. Car builders		Railway Workshops
Electrical equipment		English Electric Co
2. Designation		0-6-6-0 or Co-Co
4. Axle arrangement		Co-Co
5. Date in service		1949
6. No. in service in 1949		2
7. Total weight.		129 692 kg
8. Total adhesive weight		129 692 kg
9. Total weight of mechanical parts		72 925 kg
10. Total weight of electrical equipment		56 675 kg
11. Diameter of new motored wheels		1 067 mm
12. Diameter of new non-motored wheels		—
13. Type of axle bearings		Tapered roller
14. Wheel balance ?		Both
15. Type of brake		Vaccum and hand emergency
16. Brake leverage.		10 : 7
17. Braking of non-motored axles.		—
18. No. of brake blocks per wheel		2
19. 1 Hr HP at motor shaft per motor		204 HP
20. 1 Hr HP at Wheel tread per motor		200 HP
21. Continuous HP at motor shaft per motor		181 HP
22. Continuous HP at Wheel tread per motor		178 HP
23. Maximum axle load		21 692 kg
24. Coefficient of utilisation of adhesive weight.		—
25. Adhesive weight at wheel rim per HP at continuous rating		115.8 kg/HP
26. One hour tractive effort at wheel tread per motor		8 391.6 kg
27. Continuous tractive effort at wheel tread per motor.		6.804 kg
28. Maximum tractive effort at wheel tread per motor		—
29. Maximum variation in draw-bar pull		—
30. Current supply.		—
31. Number of traction motors		6
32. Type of motor.		Series
33. Maximum voltage per armature		460 V
34. Motor connections		None
35. Speed at 1 hour rating		53 km/h
36. Speed at continuous rating		56.5 km/h
37. Maximum test speed		149 km/h
38. Arrangement of motors.		3 sets of two in series
QUESTION 7.		
Publications in which vehicles are described		<i>The Railway Gazette</i> (London)

Great Indian Peninsula Railway

Metropolitan Vickers electric passenger locomotives	Metropolitan Vickers electric freight locomotives	Multiple unit electric motor cars
Metropolitan Vickers. Metropolitan Vickers. EA/1 1-Co-2 1928 23 103 330 kg 64 400 kg 67 577 kg 35 753 kg 1 600 mm 1 092 mm	Metropolitan Vickers. Metropolitan Vickers. EF/1 Co-Co 1927 41 124 821 kg 124 821 kg 73 155 kg 51 166 kg 1 220 mm —	English Electric Co. Ltd. English Electric Co. Ltd. — — 1925 53 Motors. 153 Trailers. 63 452 kg 63 452 kg 15 900 kg — 1 092 mm —
Inside type — Armstrong oilers and force feed pump. — Compressed air. 9 : 1 One bogie wheels only. 2 457 HP — 360 HP — 24 100 kg — 135 kg/HP 2 210 kg 1 275 kg — 1 500 V. D. C. 6 Series. 750 V Series — parallel. 50 km/h 57.5 km/h 136 km/h —	Inside type — Armstrong oilers. — Compressed air. 8 : 1 — 2 650 HP — 600 HP — 22 400 kg — 224 kg/HP 2 030 kg 1 450 kg — 1 500 V. D. C. 4 Series. 1 500 V Series — parallel. 29 km/h 33 km/h 72 km/h —	Outside type — cotton waste lubrication. — Compressed air. — 2 275 HP 234 HP — 9 250 kg — 290 kg/HP 1 440 kg — 1 420 kg — 1 500 V. D. C. 4 Series. 750 V Series — parallel. 88 km/h — 88 km/h —
—	—	—

QUESTION	Multiple unit electric motor cars
<p>1. Car builders</p> <p>Electrical equipment</p> <p>2. Designation</p> <p>4. Axle arrangement</p> <p>5. Date in service</p> <p>6. No. in service in 1949</p> <p>7. Total weight.</p> <p>8. Total adhesive weight</p> <p>9. Total weight of mechanical parts</p> <p>10. Total weight of electrical parts</p> <p>11. Diameter of new motored wheels</p> <p>12. Diameter of new non-motored wheels</p> <p>13. Type of axle bearings</p> <p>14. Wheel balance ?</p> <p>15. Type of brake</p> <p>16. Brake leverage</p> <p>17. Braking of non-motored axles</p> <p>18. No. of brake blocks per wheel</p> <p>19. 1 Hr. HP at motor shaft per motor</p> <p>20. 1 Hr. HP at wheel tread per motor</p> <p>21. Continuous HP at motor shaft per motor</p> <p>22. Continuous HP at wheel tread per motor</p> <p>23. Maximum axle load</p> <p>24. Coefficient of utilisation of adhesive weight.</p> <p>25. Adhesive weight at wheel rim per HP at continuous rating</p> <p>26. One hour tractive effort at wheel tread per motor</p> <p>27. Continuous tractive effort at wheel tread per motor.</p> <p>28. Maximum tractive effort at wheel tread per motor</p> <p>29. Variation in drawbar pull.</p> <p>30. Current supply.</p> <p>31. Number of traction motors</p> <p>32. Type of motor.</p> <p>33. Maximum voltage per armature</p> <p>34. Motor connections</p> <p>35. Speed at 1 hour rating</p> <p>36. Speed at continuous rating</p> <p>37. Maximum test speed</p> <p>38. Arrangement of motors.</p>	<p>Metropolitan Cammell and Birmingham Carriage and Wagon Companies English Electric Co. General Electric Co. (U. S. A.) Metropolitan Vickers I.M.I.P.; I.M.2; 2.M.1; 2.M.2. Bo-Bo 1927 268 58 513 kg 58 513 kg — — 1 030 mm — 63 sleeve type Latest-roller. None. Vacuum. 1 : 8.28 — 2 I.M.I.P; I.M. 2 : 2. M. I : 2. M. 201 HP 309 HP 189 HP 290 HP 185 HP 285 HP 174 HP 268 HP 8 475 kg — 260.1 kg/HP 1 270 kg 894 kg 2 700 kg — 3 000 V. D. C. 4 Series. 1 500 V Series — parallel 96 km/h 104 km/h 114 km/h —</p>
<p>QUESTION 7.</p> <p>Publications in which vehicles are described</p>	<p><i>Journal of the I. E. E.</i> (London) Vol. 66, 1928. <i>Journal of the S. A. I. E. E.</i> Vol. 38 <i>S.A.R. Magazine.</i> Feb. 1937, Mar. a Nov. 1940.</p>

South African Railways

1. E. Class Electric locomotives

Swiss Locomotive and Machine Works.
Werskpoor & Co., Holland.
Metropolitan Vickers.

1. E.
Bo + Bo
1927
187
66 600 kg
66 600 kg
39 000 kg
27 600 kg
1 220 mm

—
Sleeve or roller.

—
Air with vacuum train brake.
9.06 : 1

—
2
300 HP

282 HP
285 HP
268 HP

—
242.8 kg/HP
2 810 kg
1 880 kg
4 490 kg
2 360 kg
3 000 V. D. C.
6

—
1 500 V
Series — parallel.
35 km/h
39 km/h
81 km/h
—
—

3. E. Class electric locomotives

Stephenson & Hawthorns, England.
Metropolitan Vickers.

3. E.
Co + Co
1947
28
111 100 kg
111 100 kg
65 200 kg
45 900 kg
1 220 mm

—
Roller.

—
Air with vacuum train brake.
8.09 : 1

—
2
450 HP

423 HP
380 HP
358 HP

—
—
—
—
—
3 000 V. D. C.
6

—
1 500 V
Series — parallel

Continued

QUESTION	Eo and Ec Electric locomotives
<ol style="list-style-type: none"> 1. Car Builders. Electrical Equipment 2. Designation 4. Axle arrangement 5. Date in service 6. No. in service in 1939 7. Total weight. 8. Total adhesive weight 9. Total weight of mechanical parts 10. Total weight of electrical parts 11. Diameter of new motored wheels 12. Diameter of new non-motored wheels 13. Type of axle bearing 14. Wheel balance ? 15. Type of brake 16. Brake leverage. 17. Braking of non-motored axles. 18. No. of brake blocks per wheel 19. 1 Hr. HP at motor shaft per motor. 20. 1 Hr. HP at wheel tread per motor 21. Continuous HP at motor shaft per motor 22. Continuous HP at wheel tread per motor 23. Maximum axle load 24. Coefficient of utilisation of adhesive weight. 25. Adhesive weight at wheel rim per HP at continuous rating 26. One hour tractive effort at wheel tread per motor 27. Continuous tractive effort at wheel tread per motor. 28. Maximum tractive effort at wheel tread per motor 29. Variation in drawbar pull. 30. Current supply. 31. Number of traction motors 32. Type of motor. 33. Maximum voltage per armature 34. Motor connections 35. Speed at 1 hour rating 36. Speed at continuous rating 37. Maximum test speed 38. Arrangement of motors. 	<p>English Electric Co. Ltd. English Electric Co. Ltd. Eo and Ec Bo + Bo Eo 1924 Ec 1929 11</p> <p>50 000 kg 50 000 kg — — 1 120 mm — White metal — Westinghouse auto. Eo 12.5 : 1 Ec 8 : 1 — 2 Eo 170 HP Ec 297 HP 144 HP 264 HP 120 HP 235 HP 102 HP 209 HP 12 500 kg — 122.5 kg/HP 59.7 kg/HP 7 720 kg 8 000 kg 4 360 kg 5 680 kg 13 500 kg 18 500 kg 2 720 kg 3 260 kg 1 500 V. D. C. 4 — 750 V Series — parallel 29 km/h 48 km/h 34.5 km/h 55 km/h 64 km/h 85 km/h —</p>
<p>QUESTION 7.</p> <p>Publications in which vehicles are described</p>	<p>English Electric Co. Journals.</p>

New Zealand Government Railways

Ed Electric locomotives

English Electric Co. Lt.
English Electric Co. Ltd.Ed.
1 — Do — 2
1929
1087 450 kg
63 950 kg—
—
1 120 mm
775 mm
Roller.

Westinghouse A7EL

7.1 : 1
No.
1
310 HP
276 HP
225 HP
203 HP
16 100 kg
—
79 kg/HP
10 000 kg
6 340 kg
24 500 kg
2 720 kg
1 500 V. D. C.
4—
750 V
Series — parallel.
41 km/h
47 km/h
89 km/h
—

Multiple unit electric motor cars

English Electric Co. Ltd.
English Electric Co. Ltd.
Dm Morot car. D Trailer.Bo — Bo
1938
11 motors. 23 trailers.(111 on order)
Motor 42 700 kg Trailer 24 600 kg
42 700 kg ——
—
930 mm—
Roller.

Westinghouse E. P.

8 : 1
Yes. On trailers.
2150 HP
132 HP
106 HP
95 HP
13 260 kg—
129.6 kg/HP
4 360 kg
3 390 kg
12 200 kg—
1 500 V. D. C.
4—
750 V
Series — parallel.
43 km/h
50 km/h
96 km/h
—

B. Arrangements

8. *Name of the system of drive.*

9. *On how many vehicles is this system installed?*

Commencing year.

Arrangement of axles.

10. *Types under construction or in design, number of vehicles.*

ADMINISTRATION	
<i>British Railways (Midland Region).</i>	Name of system of drive. Number of vehicles in service. Commencing year. Types and number under construction.
<i>Great Indian Peninsula Railway.</i>	Name of system of drive : <i>a)</i> Passenger; <i>b)</i> Freight. Number of vehicles in service : <i>a)</i> Passenger; <i>b)</i> Freight. Commencing year. Types and number under construction.
<i>South African Railways.</i>	Name of system of drive. Number of vehicles in service. Commencing year. Types and number under construction.
<i>New Zealand Government Railways.</i>	Name of system of drive. Number of vehicles in service. Commencing year. Types and number under construction.

Individual drive.

Type of vehicle		
Electric locomotives	Diesel electric locomotives	Multiple unit electric motor cars
	Axle hung nose suspended motors with single reduction gear. 2 1948. None.	
Individual axle quill drive. Jack shaft drive. 24 41 1928. None.		Axle hung nose suspended motors. 53 motor cars. — 1925. None.
Axle hung nose suspended motors with straight spur reduction gear. 215 1925 & 1947 (1 — C + C — 1) 10 (Bo — Bo)	Axle hung nose suspended motors with straight spur reduction gear. 2 1939 —	Axle hung nose suspended motors with straight spur reduction gear. 268 1927 32
«Co» & «Ec» axle hung nose suspended motors. «Ed» quill drive. 1 «Eo» & «Ec», 10 «Ed» «Bo» 1924 «Ec» 1929. «Ed» 1939. 10		Axle hung nose suspended motors. 11 1938 & 1949 40

12. *One hour torque at the maximum speed in service and under maximum tractive effort.*
14. *What is the arrangement restraining the lateral movement of the motor?*
15. *Vertical forces due to the drive.*
16. *Transverse play of the axles in relation to the bogie.*
17. *Angular play in the horizontal plane of the axles in relation to the bogie.*

ADMINISTRATION	
<i>British Railways (Midland Region).</i>	<p>One hour torque. Method of restraining lateral movement.</p> <p>Vertical forces due to drive. Transverse play of axles.</p> <p>Horizontal angular play.</p>
<i>Great Indian Peninsula Railway.</i>	<p>One hour torque at maximum speed : a) Passenger; b) Freight.</p> <p>Vertical forces due to drive. Transverse play of axles. Horizontal angular play.</p>
<i>South African Railways.</i>	<p>One hour torque at maximum speed. Method of restraining lateral movement.</p> <p>Vertical forces due to drive.</p> <p>Transverse play of axles. Horizontal angular play (including play of armature shaft).</p>
<i>New Zealand Government Railways.</i>	<p>a) One hour torque at 1-Hr. speed b) Torque at maximum tractive effort</p> <p>Method of restraining lateral movement</p> <p>Vertical forces due to drive Transverse play of axles. Horizontal angular play.</p>

Type of vehicle		
Electric locomotives	Diesel electric locomotives	Multiple unit electric motor cars
	— Suspension bearing thrust faces. — 1/4" controlled by spring loaded horn faces. —	
50 000 kg/cm at 105 km/h. 145 500 kg/cm at 57 km/h. Not known. 5 mm — 8 mm. —		14 700 kg/cm at 89 km/h. Not known. 3.2 mm. 0° — 6' — 30"
243 000 kg/cm per motor at 73 km/h. <i>Axle hung motors.</i> — Suspension bearing thrust faces. 4 700 kg full field cont. rating. 7 100 kg full field 1 h rating. 11 350 kg full field max. TE. 1.5 mm — 6.5 mm. 0° — 8' — 0" to 0° — 38' — 0"		12 100 kg/cm per motor at 96 km/h. Suspension bearing thrust faces. 2 310 kg full field cont. rating. 3 200 kg full field 1 h rating. 5 250 kg full field max. TE. 1.5 mm — 6.5 mm. 0° — 11' — 0" to 0° — 45' — 0"
« Eo » — 2 000 kg/cm 4 000 kg/cm .	« Ec » — 290 000 kg/cm 670 000 kg/cm.	« Ed » — 316 000 kg/cm 780 000 kg/cm.
<p><i>Axle hung motors.</i> — Suspension bearing thrust faces. <i>Frame mounted motors.</i> — Mounting holds motor in position.</p>		
— 4.8 mm. Nil.	— 1.6 mm — 6'	— 3.2 mm. 0° — 11' — 0"

13. *Details of the maintenance work on the drive — maintenance intervals.*

18. *Have you given up some arrangements of drive? Which and for what reason and from what date?*

ADMINISTRATION	
<i>British Railways (Midland Region).</i>	Lubrication. Drives given up.
<i>Great Indian Peninsula Railway.</i>	Inspection and lubrication. Drives given up.
<i>South African Railways.</i>	Drives given up.
<i>New Zealand Government Railways.</i>	Lubrication. Overhaul. Drives given up.

19. *Results obtained with the driving arrangements (maintenance, purchase price and behaviour).*

ADMINISTRATION	
<i>British Railways (Midland Region.)</i>	Present drive.
<i>Great Indian Peninsula Railway.</i>	Present drive.
<i>South African Railways.</i>	Present drive.
<i>New Zealand Government Railways.</i>	Present drive.

Type of vehicle		
Electric locomotives	Diesel electric locomotives	Multiple unit electric motor cars
	Weekly. None.	
Every 35 days. None.		Suspension bearings. 15 days. Gears. 2 months. None.
ble gears incorporating helical rings were abandoned due to ring breakage and lubrication difficulties.		
2 weekly. 320 000 km (3-4 years). re designs will probably not body frame mounted motors cause of the excess length of the id wheel base which offsets vantage of lower unsprung ight.		2 weekly. Flexible gears were abandoned due to spring failures and no apparent improvement in performance.

Type of vehicle		
Electric locomotives	Diesel electric locomotives	Multiple unit electric motor cars
	No experience of other drives.	
Satisfactory.		Satisfactory.
Results are generally satisfactory, but some form of resilience in the drive is considered essential.		
» and « Ec » locomotives. (Axle g motors) satisfactory and inexpensive. » locomotives. (Frame mounted tors). actory but maintenance costs high. The wear on the drive is ater than with axle hung motors.		Satisfactory and comparatively inexpensive.

20. What is your experience of the riding of the motor vehicles on the road (where it concerns the construction of the individual drive)? Does your reply on the subject take account of the point of view of the Permanent Way Department? If not, what is the point of view of the Permanent Way Department? What is that of the Motive Power Department?

ADMINISTRATION	
<i>British Railways (Midland Region).</i>	<i>Riding.</i> As affected by type of drive : a) C. M. E. Department. b) P. W. Department.
<i>Great Indian Peninsula Railway.</i>	<i>Riding.</i> As affected by type of drive.
<i>South African Railways.</i>	<i>Riding.</i> As affected by type of drive.
<i>New Zealand Government Railways.</i>	<i>Riding.</i> As affected by type of drive.

21. What are the proved advantages or disadvantages from the point of view of the maintenance of the track of the running of electric motor vehicles?
What is the influence of the diameter of the wheels on the deterioration of the track at high speeds?
22. Have you yet made tests of the vehicle while running and measured forces between wheel and rail?
1. With nose suspended motor.

ADMINISTRATION	
<i>British Railways (Midland Region.)</i>	Effect of electric vehicle on track. Tests.
<i>Great Indian Peninsula Railway.</i>	Effect of electric vehicle on track. Tests.
<i>South African Railways.</i>	Effect electric of vehicle on track. Tests.
<i>New Zealand Government Railways.</i>	Effect of electric vehicle on track.

Type of vehicle		
Electric locomotives	Diesel electric locomotives	Multiple unit electric motor cars
	Good. No complaints.	
Satisfactory.		Satisfactory.
drive used does not seem to have any detrimental effect on riding.		The construction of the individual drive does not seem to have any effect on riding.
Eo » and « Ec » locomotives. Satisfactory at low speed. (se locos. have no swing bolsters). « Ed » locos. Satisfactory.		

With motor having flexible drive.
 are the results of these tests and method of measurement?
 you give sources of data concerning theoretical calculations of the forces between rail and wheel or of tests,
 and such calculations or results of tests to your reply?
 (See also questions 58, 59 & 60.)

Type of vehicle		
Electric locomotives	Diesel electric locomotives	Multiple unit electric motor cars
	— —	
— None.	—	— None.
Track wear appears to be more severe. (See attached sheet.) Lateral forces appear to be about 100 % greater than for a steam loco. (See attached sheet.)		
The Permanent Way Department is reporting this question separately.		

ATTACHMENT TO
QUESTIONS 21 and 22.**South African Railways.**

21. — Electric motor vehicles generally have the reputation of hunting more at high speed than steam-powered locomotives. Such hunting on straight track of the new (Class 3E) series of electric locomotives has been severe enough to kink the track and produce noticeable side wear on the rails at intervals approximating 50 to 60 feet. Corrugation of a serious nature on sharp curves of the Natal main line is also in part attributable to the operation of electric locomotives. It is thought that the practice of operating the locomotives in regeneration on the steep grades of the down line leads to excessive side forces on the rail heads from the wheels of the locomotives, the result being that relative sideways deflections between sleepers and over sleepers are accentuated and surface wheel-slip produced. However, it is probable that corrugation would be present under the heavy traffic even in the absence of electric locomotives and similar, though less intense, corrugation is in fact occurring on steam-operated lines, particularly on check railed curves.

There has been a noticeable tendency for the articulated bogie type of electric locomotive, such as the Class 1E, 2E and 3E, to be very severe on curves. The trouble was so acute when the class 1E locomotives were first introduced on the Natal main line, in 1926, that epidemic failures of 80-lb. rails occurred. The failures were traced to the severe lateral forces exerted by the wheels of the locomotives on the side of the rail heads and they took the form of longitudinal web-flange junction cracks over sleepers on the high and low leg rails. Alterations were made to a number of units to increase the play in the articulated joint, but although the track benefited through reduced side forces, tyre wear increased sharply, by some 40 per cent. The trouble had finally to be overcome by the replacement of all 80-lb. rails on sharp curves by 85-lb. or heavier sections. Today the track is completely laid with 96-lb. rails. The same tendency has been noted on the Class 3 locomotives, recently imported, and is being watched carefully. Excessive tyre wear is already occurring and wear on turn-outs is being investigated owing to suspected tightness of the vehicles in the curves.

No influence of wheel diameter on track deterioration has been detected.

22. — The forces between wheel and rail in the case of the Class 1E locomotives were measured in 1926 by means of a device which recorded the lateral rail-head movement in relation to the base of the rail on curved track. The instrument gave a magnification of 19 and deflections from the electric units some 40 per cent greater than those from steam locomotives were recorded.

A test with a similar instrument was made recently on straight track to record the lateral forces exerted by the new Class 3E units while hunting. A maximum flange pressure of about 16 tons was evident at 60 m.p.h., and it seems probable that a single bogie was exerting about 40 tons of side pressure on the track at this speed.

23. *What is the trend of your ideas for the future?*
 24. *Have you any special remarks to make?*

ADMINISTRATION	
<i>British Railways (Midland Region).</i>	Future trends.
<i>Great Indian Peninsula Railway.</i>	Future trends.
<i>South African Railways.</i>	Future trends.
<i>New Zealand Government Railways.</i>	Future trends.

25. *Do you prefer, from the point of view of the transmission and its maintenance, inside or outside axleboxes? Why?*
 26. *Do you consider that the motor should be placed as low as possible or that it would be better above the motor axle?*

ADMINISTRATION	
<i>British Railways (Midland Region).</i>	Axle boxes. Motor position.
<i>Great Indian Peninsula Railway.</i>	Axle boxes. Motor position.
<i>South African Railways.</i>	Axle boxes. Motor position.
<i>New Zealand Government Railways.</i>	Axle boxes. Motor position.

Type of vehicle		
Electric locomotives	Diesel electric locomotives	Multiple unit electric motor cars
	To retain the simplicity of nose suspended motors.	
axle double bogie for passenger service.		
lient drives, probably of the rubber bushed type.		
Axle hung nose suspended motors with rigid drive.		

Type of vehicle		
Electric locomotives	Diesel electric locomotives	Multiple unit electric motor cars
	Outside for accessibility and ease of maintenance. No opinion.	
side for ease of access.		Outside for ease of access.
As high as possible due to wide-spread risk of flooding in rainy weather.		
	Outside due to narrow gauge (1 068 mm).	
	As low as possible for stability.	
	Outside	
	As low as possible due to limited head room.	

27. Number of vehicles which employ this type of drive :

In 1940

In 1949

Max.

- a) Locomotives { Goods
 { Passenger
 b) Electric motor cars
 c) Diesel electric rail cars

ADMINISTRATION	
<i>British Railways (Midland Region.)</i>	Number of vehicles in service with this type of drive : a) 1940. b) 1949. Per cent of drive in relation to : a) No. of motor axles. b) No. of motor vehicles. Maximum speed.
<i>Great Indian Peninsula Railway.</i>	Number of vehicles in service with this type of drive : a) 1940. b) 1949. Per cent of drive in relation to : a) No. of motor axles. b) No. of motor vehicles. Total number of motor axles fitted. Maximum speed.
<i>South African Railways.</i>	Number of vehicles in service with this type of drive : a) 1940. b) 1949. Per cent of drive in relation to : a) No. of motor axles, { b) No. of motor vehicles. { Maximum speed.
<i>New Zealand Government Railways.</i>	Number of vehicles in service with this type of drive : a) 1940. b) 1949. Per cent of drive in relation to : a) No. of motor axles. b) No. of motor vehicles. Total number of motor axles fitted. Maximum speed.

. What is the percentage of each type of individual drive :

a) In relation to the total number of motor axles;

b) In relation to the total number of motor vehicles, electric and diesel electric.

. Total number of motor axles fitted with each of these types.

. For a constant speed of rotation of the axle what are the possible maximum variations in speed of the motor?

Type of vehicle		
Electric locomotives	Diesel electric locomotives	Multiple unit electric motor cars
	Axle hung. 0 2 100 % 100 % 121 km/h.	
Axle quill drive. 24 24 14 % 21 % 75 138 km/h.	Jack shaft. 41 41 46 % 35 % 246 73 km/h.	Axle hung. 53 53 40 % 44 % 212 88 km/h.
Axle hung. 187 225	Axle hung. 2 2	Axle hung. 214 269
Only one type of drive employed.		
96 km/h.		96 km/h.
« Eo » and « Ec » axle hung. 11 11 9 % (incl. motor cars) % 8 (incl. motor cars) Rated 85 km/h.	« Ed » quill. 10 10 31 % 31 % 40 Rated 89 km/h.	Axle hung. 6 11 — — Rated 96 km/h.

31. *Lateral play of the drive.*

32. *Supposing the motor axle be fixed, how many degrees, minutes and seconds, can the armature of the motor turn under the motor torque at the one hour rating, continuous rating at the maximum speed and at start? At what motor torque do the springs of the drive commence to flex?*

ADMINISTRATION	
<i>British Railways (Midland Region).</i>	Lateral play of drive. ° of rotation at one hour torque. Flexing torque. Weight of drive (without gears). Gear ratio. Gear teeth.
<i>Great Indian Peninsula Railway.</i>	Lateral play of drive. ° of rotation at one hour torque. Weight of drive (without gears) . Gear ratio : a) Passenger. b) Freight. Gear teeth : a) Passenger. b) Freight.
<i>South African Railways.</i>	Lateral play of drive. ° of rotation at one hour torque. ° of rotation at starting torque. Weight of drive without gears. Gear ratio. Gear teeth.
<i>New Zealand Government Railways.</i>	Lateral play of drive. ° of rotation at one hour torque. ° of rotation at starting torque. Weight of drive without gears. Gear ratio. Gear teeth.

of the drive and without the train of gear wheels and pinions (if possible). Total sprung weight and total weight of the mechanism of the drive for each axle.

ratio.

with straight or inclined teeth (Why) ?

Type of vehicle		
Electric locomotives	Diesel electric locomotives	Multiple unit electric motor cars
	0.8 mm. — — — 3.06 : 1 Straight, due to absence of side thrust.	
1.6 mm. Not known. Not known. 1 : 3.66 1 : 4.15 Straight Helical.		8 mm. Not known. Not known. 1 : 3.571 — Straight. —
None. Class 1E Nil. Class 1E Nil. — Classes 1E, 2E, ES Class 3E Straight.	Class 3E 0°14'10" Class 3E 0°15'18" — 17 : 75 23 : 71	None. — — 23 : 72 — Straight.
6.3 mm. — — — 3.33 : 1 Straight.		6.3 mm. — — — 3.71 : 1 Straight.

36. Material of the pinions and gear wheels, chemical and physical characteristics.

ADMINISTRATION	
<i>British Railways (Midland Region)</i>	Properties of materials for : a) Pinions. b) Gears.
<i>Great Indian Peninsula Railway.</i>	Properties of materials for : a) Pinions. b) Gear. c) Jack shaft.
<i>South African Railways.</i>	Properties of materials for : a) Pinions. b) Gears.
<i>New Zealand Government Railways.</i>	Properties of materials for : a) Pinions. b) Gears.

37. Have you locomotives with connecting rods? If so, what are the reasons which decided you to use also the in-
38. Would you advise that the motor should be rigidly fixed to the frame and that transmission to the motor ax-
of the two systems?

ADMINISTRATION	
<i>British Railways (Midland Region.)</i>	Preference for type of drive : a) Connecting rods; b) Motor suspension.
<i>Great Indian Peninsula Railway.</i>	Preference for type of drive : a) Connecting rods; b) Motor suspension.
<i>South African Railways.</i>	Preference for type of drive : a) Connecting rods; b) Motor suspension.
<i>New Zealand Government Railways.</i>	Preference for type of drive : a) Connecting rods; b) Motor suspension.

Type of vehicle			
Electric locomotives		Diesel electric locomotives	Multiple unit electric motor cars
		.42% C .57% Mn .215% Si .028% S .028% Ph. Carbon chrome molybdeum steel.	
Passenger	Freight		
40 % S .028 % 02 % Mn .34 % 27 % Ni 2.04 % .18 % 31 % Ni .28 % 1.3 %	C .54 % S .03 % Ph .026 % Mn .60 % Si .16 % C .37 % Ni .16 % Ch .1 %		Si .32% S. 0.16% Ph .014 % Mn .29% Ni 5.19% Ch 12.50
.45 — .50 % carbon steel. Oil or water hardened 450-500 Br. .45 — .50 % carbon steel. Oil or water hardened 450-500 Br. or molybdenum steel oil hardened 300-340 Brinell.			Not known. Not known.
Not known. Not known.			Not known. Not known.

al drive?
ld be flexible or rather that a nose suspended motor with fixed gears is satisfactory; limit of application

Type of vehicle		
Electric locomotives	Diesel electric locomotives	Multiple unit electric motor cars
	None used. Nose suspended motor with fixed gears.	
shaft used on freight locomotives. y fixed motors are satisfactory all locomotives.		Not used. Nose suspended motors are satisfactory.
None used. Nose suspended motors with resilience in the drive have proved satisfactory.		
None used. Flexible nose suspension with solid gear wheels is the most satisfactory of the types of suspension tried.		

39. *Effect of the passage of electric current on the running and maintenance of the parts of the drive. For example on the bearings or springs.*
40. *Results in service of each type of drive with all the information possible concerning :*
- a) *Breakage of springs;*
 - b) *Fracture of teeth;*

ADMINISTRATION	
<i>British Railways (Midland Region).</i>	Performance of drive : a) Effect of electric current. b) Failures.
<i>Great Indian Peninsula Railway.</i>	Performance of drive: a) Effect of electric current. b) Breakage of springs. c) Fracture of teeth. d) Failure rate/500 000 km/axle. e) Measures to avoid failure. f) Cost of maintenance.
<i>South African Railways.</i>	Performance of drive. a) Effect of electric current. b) c) d) & e) f) Measures to avoid failure. g) Cost of maintenance.
<i>New Zealand Government Railways.</i>	Performance of drive : a) Effect of electric current. b) Breakage of springs. c) Fracture of teeth. d) Failure rate. e) Measures to avoid failure. f) Cost of maintenance.

- c) Various failures and abnormal wear;
 d) Causes to which they are attributable;
 e) Number of failures per 500 000 kilometres per axle;
 f) Measures taken to avoid or reduce their repetition;
 g) Cost of maintenance of each type of transmission.

Type of vehicle			
Electric locomotives		Diesel electric locomotives	Multiple unit electric motor cars
		Not applicable. No failures have occurred.	
Passenger	Freight		None No springs used. Unusual. .5 Pinions. .3 Gears. It is considered that these failures represent full mileage that can be expected in the life of the gears and pinions.
viewed every overhaul. not give trouble. Exceptional. .75 pinions. n gears still in service r 19 000 000 km.	A few double cantilever springs have been changed. Exceptional. Pinion and jack shaft have completed 1 000 000 km.		
—	—		
—	—		
—	—		
Lead and brush to the axle is considered essential to avoid pitting of roller bearings and damage to white metal bearings.			
Attached sheets — 17/1, 17/2, 17/3, 17/4.			
Use of rubber bushes in gears to reduce shock transmitted to the teeth. Taper grinding of the tooth is being considered to avoid their intrinsic loading.			
No effects observed. In some cases a lead and brush to the axle is used.			
ss « Eo » and « Ec ».	Class « Ed »		
None used.	Breakage of quill springs fairly frequent.		Coil springs in gear wheels collapsed.
erous failures due to unsatisfactory material.	None.		None.
—	—		—
placed by pinions of er quality.	Springs replaced by rubber. Proved unsatisfactory		Springs replaced by solid blocks.
Not known.	Not known, but quill drive is very expensive.		Not known

SOUTH AFRICA Record of gear wheel failures

Year (Calendar)	No. of broken gears	Average mileage	Make of gear			
			A. Wiseman		English electric 6387	
			No.	Average mileage	No.	Average mileage
1942	2	220 435	1	313 670	—	441 415
1943	3	309 324	1	307 217	1	609 504
1944	20	535 034	—	—	13	631 257
1945	18	600 930	6	587 274	9	602 999
1946	44	519 351	13	444 253	22	646 721
1947	40	843 973	13	233 408	21	695 894
1948	38	463 068	16	285 826	15	820 161
1949 (1)	14	555 136	6	304 822	5	—

(1) Up to September, 1949.

(2) Test only.

SOUTH AFRICA Record of defective and broken gears

Year (Dec.)	No. of locos. in service	Approx. No. of gears	Total No. of breakages in year	Average mileage run.	Analyse Number					
					Rigid gears					T
					Broken or fractured teeth	Loose gear	Burst or broken gears	Worn gears	Miscel- laneous (damaged etc.)	
1933	95	380	5	69 254	4	—	—	—	1	
1934	95	380	31	66 891	23	1	5	—	2	
1935	95	380	66	125 212	35	1	12	—	18	
1936	95	380	74	163 197	11	—	42	—	15	
1937	123	492	103	246 198	6	1	69	—	26	
1938	169	676	89	255 526	11	1	52	4	1	
1939	162	648	37	261 519	5	—	21	1	—	
1940	162	648	42	255 814	3	10	13	—	—	
1941	162	648	46	302 110	10	6	13	2	1	
1942	166	664	12	285 441	—	—	2	—	—	
1943	164	656	25	306 026	2	—	6	2	—	
1944	167	668	22	323 123	8	1	1	1	3	
1945	169	676	18	284 289	5	—	—	2	1	
1946	171	684	27	318 673	9	—	5	4	—	
1947	171	684	20	321 222	11	—	4	1	—	
1948	167.1E 6.3E	704	12	383 490	5	—	3	—	—	

WAYS.
Motor coaches. — Cape.

detachable rim)						Defects			
English electric H. 551		English electric (tool steel)		Krupp		Teeth root cracks	Teeth broken or damaged	Rim cracked	Gear- wheel burst or broken
No.	Average mileage	No.	Average mileage	No.	Average mileage				
1	127 200	—	—	—	—	2	—	—	—
1	179 340	—	—	—	—	1	1	—	1
5	474 129	2	203 244	—	—	10	7	—	3
2	697 865	1	270 062	—	—	11	4	—	3
3	645 079	6	312 486	—	—	20	14	—	10
4	508 505	2	354 732	—	—	16	16	—	8
4	261 384	1	915 430	2	712 002 (2)	15	14	—	9
1	449 596	2	697 285	—	—	8	3	1	2

WAYS.
electric locomotives. — Natal.

defects									
es due to :									
Resilient gears									
aged gear	Defective gear	Damaged or broken teeth	Blocks and centres worn	Broken springs spiders etc.	Worn teeth out of mesh	Loose gear	Broken gear	Worn gear	Total
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	6
1	—	—	5	—	—	—	—	—	1
1	—	—	—	—	—	—	—	—	20
—	2	1	—	14	1	—	1	1	10
2	1	1	—	2	1	—	1	2	16
—	—	—	5	7	—	3	—	1	14
—	—	3	—	4	—	2	2	3	10
1	—	—	—	5	—	2	—	2	15
1	—	1	1	9	—	—	1	2	8
3	—	1	—	—	—	—	—	4	10
—	1	3	—	1	1	—	1	3	9
4	2	—	2	—	—	—	—	1	4
—	—	2	—	1	—	—	—	—	4
1	—	2	—	1	—	—	—	—	—

SOUTH AFRICA

Analysis of defective gear wheels

Year (December)	Total number of defects in year		(*) Analysis of total			
			Resilient			
			(A) Ordinary resilient		(B) Reconditioned resilient	
	No.	Average mileage	No.	Average mileage	No.	Average mileage
1933	5	69 254	—	—	—	—
1934	31	66 891	—	—	—	—
1935	66	125 212	—	—	—	—
1936	74	163 197	6	37 582	—	—
1937	103	246 198	7	54 406	—	—
1938	89	255 526	27	88 014	—	—
1939	37	261 519	35	102 545	2	23 751
1940	42	255 814	47	134 646	6	109 347
1941	46	302 110	60	166 047	7	102 424
1942	12	285 441	70	186 337	7	102 424
1943	25	306 026	84	208 419	8	125 730
1944	22	323 123	92	221 744	8	125 730
1945	18	284 289	101	233 466	9	135 219
1946	27	318 673	102	236 370	17	198 106
1947	20	321 222	106	240 875	17	198 106
1948	12	383 490	110	232 116	17	198 106

(*) Results shown are accumulative and not in respect of individual years.

WAYS.

as. — Electric locos. — Natal.

933 to date

Total (A) and (B)		Solid					
		(A) Solid centre with detachable rim		(B) Complete solid gear		Total (A) and (B)	
No.	Average mileage	No.	Average mileage	No.	Average mileage	No.	Average mileage
—	—	5	69 254	—	—	5	69 254
—	—	36	67 219	—	—	36	67 219
—	—	102	104 744	—	—	102	104 744
6	37 582	170	132 559	—	—	170	132 559
7	54 406	272	175 507	—	—	272	175 507
7	88 014	341	200 834	—	—	341	200 834
7	98 286	368	208 968	—	—	368	208 968
3	131 782	394	213 951	—	—	394	213 951
57	159 399	425	222 003	1	147 050	426	218 272
77	178 709	427	221 770	1	147 050	428	221 595
92	201 337	437	223 304	1	147 050	438	231 303
90	214 063	449	225 688	3	207 465	452	225 567
10	225 428	454	226 041	6	176 719	460	225 398
19	230 904	464	226 457	14	251 279	478	227 184
23	234 964	466	227 507	28	270 605	494	229 869
27	227 563	469	227 844	33	274 190	502	230 891

SOUTH AFRICA

Record of defective and broken gear wheels

Year	Total defects in year (all types)		(*) Analysis of defects and approximate mileage run by each gear wheel									
			Metro-Vicks (Nickel chrome)		M. V. Ltd.		A. Wiseman		David Brown		Brown Bayley	
	No.	Average mileage	No.	Average mileage	No.	Average mileage	No.	Average mileage	No.	Average mileage	No.	Average mileage
1933	5	69 254	5	69 254	—	—	—	—	—	—	—	—
1934	31	66 891	20	83 208	—	—	10	35 610	—	—	—	—
1935	66	125 212	41	139 851	2	122 893	18	97 644	1	138 690	3	100 400
1936	74	163 197	21	201 803	1	221 403	41	159 242	2	179 624	3	167 800
1937	103	246 198	15	264 391	7	203 484	74	248 363	3	232 222	3	245 200
1938	89	255 526	7	350 305	7	189 472	53	308 243	—	—	—	—
1939	37	261 519	1	393 274	3	213 322	21	333 519	—	—	—	—
1940	42	255 814	1	321 477	6	105 528	14	444 412	—	—	—	—
1941	46	302 110	2	335 371	12	206 068	14	443 243	—	—	—	—
1942	12	285 441	—	—	—	—	—	—	—	—	—	—
1943	25	306 026	1	154 441	3	378 975	3	292 386	—	—	—	—
1944	22	323 123	—	—	5	389 442	1	441 369	—	—	—	—
1945	18	284 289	—	—	—	—	—	—	—	—	—	—
1946	27	318 673	—	—	3	391 115	—	—	—	—	—	—
1947	20	321 222	—	—	1	447 599	—	—	—	—	—	—
1948	12	383 490	—	—	1	199 367	5	294 267	—	—	—	—
Highest mileage run by any one gear			393 274		523 991		691 055		234 317		277 200	
Lowest mileage run by any one gear			60 806		23 875		26 271		138 690		91 600	

(*) Results shown are respect of specific defects in individual year.

WAYS.

ms. — Electric locomotives. — Natal.

ge mileages under specific make

S. A. steel	Taylor		Beardmore		Bochumer Verein		Complete solid gears		Resilient			
							A. Wiseman		Re-conditioned		Ordinary	
Average mileage	No.	Average mileage	No.	Average mileage	No.	Average mileage	No.	Average mileage	No.	Average mileage	No.	Average mileage
—	—	—	—	—	—	—	—	—	—	—	—	—
53 357	—	—	—	—	—	—	—	—	—	—	—	—
86 813	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	6	37 582
—	—	—	—	—	—	—	—	—	—	—	1	155 348
315 494	—	—	—	—	—	—	—	—	—	—	20	99 776
189 916	—	—	—	—	—	—	—	—	2	23 750	8	151 591
43 986	—	—	—	—	—	—	—	—	4	152 145	12	228 274
235 242	—	—	—	—	—	—	1	147 050	1	60 891	13	279 571
—	1	187 596	1	156 878	—	—	—	—	—	—	10	308 081
—	3	239 890	—	—	—	—	—	—	1	288 860	14	319 542
226 405	4	227 169	—	—	—	—	2	237 673	—	—	8	360 412
226 487	3	180 195	—	—	1	521 479	3	145 973	1	211 141	9	360 412
300 504	4	330 292	1	370 597	—	—	8	307 199	8	268 856	1	52 603
—	1	494 778	—	—	—	—	14	289 931	—	—	4	355 758
446 415	1	204 392	—	—	—	—	—	—	—	—	4	570 088
446 415		494 778		370 597		521 479		610 512		554 145		762 524
20 005		58 333		156 878		521 479		38 927		36 755		27 866

41. Supply particulars on the subject of the possible substitution of rubber suspension for metal springs.

42. Has one or other arrangement of drive been adopted for one of the following motives :

a) Reduction in damage to the track;

ADMINISTRATION	
<i>British Railways (Midland Region).</i>	Rubber suspension. Other arrangements of drive.
<i>Great Indian Peninsula Railway.</i>	Rubber suspension. Other arrangements of drive.
<i>South African Railways.</i>	Rubber suspension. Other arrangements of drive.
<i>New Zealand Government Railways.</i>	Rubber suspension. Other arrangements of drive.

43. Name of the type of bogie.

44. On how many vehicles is the type installed?

Commencing in what year?

ADMINISTRATION	
<i>British Railways (Midland Region).</i>	Name of type of bogie. No. of vehicles on which bogie is installed. Axle arrangement. Commencing year. Types under construction.
<i>Great Indian Peninsula Railways.</i>	Name of type of bogie. No. of vehicles on which bogie is installed. Axle arrangement. Commencing year. Types under construction.
<i>South African Railways.</i>	Name of type of bogie. No. of vehicles on which bogie is installed. Axle arrangement. Commencing year. Types under construction.
<i>New Zealand Government Railways.</i>	Name of type of bogie. No. of vehicles on which bogie is installed. Axle arrangement. Commencing year. Types under construction.

Improvement in the riding of the vehicle;
Reduction in cost of maintenance of the vehicle.

Type of vehicle		
Electric locomotives	Diesel electric locomotives	Multiple unit electric motor cars
Not tried.		
Not tried.		
Drives accepted as supplied.		
Rubber suspension on spring hangers of motor coaches has been very satisfactory. Only one type in use.		
Rubber has been used in place of springs in the quill cups, but the rubber pads disintegrated under load.		Retention of flexibility does not appear necessary, hence rubber was not adopted in place of metal springs when the latter were abandoned.
The frame mounted motor with flexible drive was introduced to reduce the stresses on the track and drive and to improve riding but experience has shown that maintenance costs are high and lateral forces of the long rigid wheel base severe on the track.		Flexible drive was adopted originally to improve riding and to avoid wear and damage to the gear teeth. In practice there was increased first cost and maintenance with no appreciable benefit.

gies.

Arrangement of axles?

45. Types under construction or in design, number of vehicles.

Type of vehicle		
Electric locomotives	Diesel electric locomotives	Multiple unit electric motor cars
—	Twin swing bolster. 2 Co — Co 1948 —	—
Passenger va truck and 4-wheeled non-equalised type. 22 1 — Co — 2 1928 3 — 6 axle. Double bogie type.	Freight Double bogie artic. type. 41 Co — Co 1927	Non equalised type. 53 motors. 153 trailers. — 1925 64 cars.
Double axle plate frames of riveted construction. 215 — 1925 and 1927 40 class 4E locomotives of similar design.		268 B 1927 32 motor cars of similar design.
E0 5 Bo — Bo 1924 —	4 wheel. Ec 6 Bo — Bo 1929 —	4 wheel. 6 Bo-Bo 1938 40
	Ed 7 1 — Do — 2 1938 7 Bo-Bo-Bo	

47. *What is the electrical connection of the motors mounted on a bogie?*

Advantages or disadvantages resulting from this connection.

48. *One hour torque at maximum speed in service and for maximum tractive effort.*

ADMINISTRATION	
<i>British Railways (Midland Region).</i>	Electrical connections of motors. One hour torque.
<i>Great Indian Peninsula Railway.</i>	Electrical connections of motors. One hour torque : a) At max. speed.
<i>South African Railways.</i>	Electrical connections of motors. One hour torque : a) At max. speed.
<i>New Zealand Government Railways.</i>	Electrical connections of motors. One hour torque : b) Max. tractive effort.

49. *Particulars of the maintenance work and frequency.*

ADMINISTRATION	
<i>British Railways (Midland Region).</i>	Maintenance. Intermediate overhaul.
<i>Great Indian Peninsula Railway.</i>	Inspection. Intermediate overhaul. Overhaul.
<i>South African Railways.</i>	Inspection. Overhaul.
<i>New Zealand Government Railways.</i>	Light inspection. Inspection. Wheel and brake overhaul. Heavy overhaul.

Type of vehicle		
Electric locomotives	Diesel electric locomotives	Multiple unit electric motor cars
—	Not applicable. —	—
—	—	32 500 kg/cm.
—	—	—
Permanent series. — To reduce motor voltage. 243 000 kg/cm.		12 100 kg/cm.
Permanent series. Eo 4 000 kg/cm.	Ec 670 000 kg/cm. Ed 780 000 kg/cm.	275 000 kg/cm.

Type of vehicle		
Electric locomotives	Diesel electric locomotives	Multiple unit electric motor cars
—	—	—
—	—	—
Passenger. 35 days. 200 000 km. 400 000 km.	Freight. 35 days. 50 000 km. 240 000 km.	10 days. — 145 000 km.
2 weekly. 194 000 km (approx.).		1 weekly. 194 000 km (approx.).
3 days. 2 weeks. 145 000 km 320 000 km (4-5 years),		3 days. 2 weeks. 145 000 km. 320 000 km (4-5 years).

50. *Horizontal forces on the rail due to the bogie.*
 51. *Transverse play of the axle in relation to the bogie.*
 52. *Angular play in the horizontal plane of the axles in relation to the bogie*

ADMINISTRATION	
<i>British Railways (Midland Region)</i>	Horizontal force on rail. Transverse play of axle. Horizontal angular play of axle.
<i>Great Indian Peninsula Railway.</i>	Horizontal force on rail. Transverse play of axle. Horizontal angular play of axle.
<i>South African Railways.</i>	Horizontal force on rail. Transverse play of axle. Horizontal angular play of axle.
<i>New Zealand Government Railways.</i>	Horizontal force on rail. Transverse play of axle. Horizontal angular play of axle.

53. *For what reasons do you not use more of certain types of bogies and which types?*

ADMINISTRATION	
<i>British Railways (Midland Region).</i>	
<i>Great Indian Peninsula Railways.</i>	Results obtained with bogie.
<i>South African Railways.</i>	Preferred type of bogie. Results obtained with bogie.
<i>New Zealand Government Railways.</i>	Preferred type of bogie.

Type of vehicle		
Electric locomotives	Diesel electric locomotives	Multiple unit electric motor cars
	Not available. 6.3 mm. Negligible.	
Not known. 3.1 mm. —		Not known. 3.1 mm. 0° — 6' — 30".
1.5 — 6.3 mm. IE loco. 0°—5'—50" to 0°—23'—20"	See Question 22.	1.5 — 6.3 mm. 0°—5'—40" to 0°—24'—40"
3.1 — 6.3 mm. Ec Ed 0° — 6' — 0" 0° — 11' — 0"	No determined.	3.1 mm. 0° — 11' — 0"

Results obtained with these bogies (maintenance, purchase price, behaviour, etc.).

Type of vehicle		
Electric locomotives	Diesel electric locomotives	Multiple unit electric motor cars
—		—
Satisfactory.	—	Satisfactory.
<p>Existing steel plate frame bogies have given satisfactory service. Cast steel bogies are being considered; the prices are, however, higher. No experience of other types.</p>		
<p>All motor bogies are of a similar design except that Eo and Ec classes are solid bolster types, and are not considered suitable for more than moderate speeds.</p>		

55. What is your experience of the riding of the motor vehicles in service (as it concerns the construction of the Does your reply on the subject take account of the point of view of the Permanent Way Department?
56. If not, what is the point of view of the Permanent Way Department? What is that of the Motive-Power De

ADMINISTRATION	
<i>British Railways (Midland Region).</i>	
<i>Great Indian Peninsula Railway.</i>	a) C. M. E. Department.
	b) P. W. Department.
<i>South African Railways.</i>	a) C. M. E. Department.
	b) P. W. Department.
<i>New Zealand Government Railways.</i>	a) C. M. E. Department.
	b) P. W. Department.

57. What is the effect of the diameter of the wheels on the deterioration of the track at high speeds?
58. Have you a rule on your system which fixes the diameter of the wheels in relation to the speed or weight on

ADMINISTRATION	
<i>British Railways (Midland Region).</i>	Effect of wheel diameter on track. Determination of wheel diameter.
<i>Great Indian Peninsula Railway.</i>	Effect of wheel diameter on track. Determination of wheel diameter.
<i>South African Railway.</i>	Effect of wheel diameter on track. Determination of wheel diameter.
<i>New Zealand Government Railways.</i>	Wheel diameter.

).

ment?

Type of vehicle		
Electric locomotives	Diesel electric locomotives	Multiple unit electric motor cars
<p>riding quality is excellent the a truck being most sensitive on ves and track irregularities.</p> <p>dverse report.</p> <p>ypes of locomotive have a ten- / to nose at speed. This is uted largely to the underframes the articulating joint between ogies.</p> <p>ical of the suitability of the articulated bogie type of locomotive, with drawgear mounted on the bogies, high speed working. It is suspected that drawbar pull on the bogies, with articulation, adversely ects lateral flange forces on curved and straight track.</p> <p>actory for moderate speeds only.</p> <p>The Permanent Way Department is reporting this question separately.</p>		
		<p>Motor coach bogies showed a tend- ency to rough riding and undue rail wear. This has now been eliminated by modifying the bogie. It has been agreed that poor track aggravated the riding quality and cyclical wear of the rails.</p> <p>The original bogie was fitted with elliptical bolster springs but consi- derable vibration was experienced. This was eliminated by fitting helical bolster springs.</p>
		Satisfactory.

the axle or limits one or other of these factors in relation to the other?

Type of vehicle		
Electric locomotives	Diesel electric locomotives	Multiple unit electric motor cars
Not known.		Not known.
Not known.		Not known.
Limited by head room and no other consideration.		

59. Have you yet made tests of the stability of the vehicles while running and measured the forces between wheel and rail?
 60. Can you give sources of data concerning theoretical calculations of the forces between rail and wheel or of the forces between vehicles and rails?
 61. What is the trend of your ideas for the future?

ADMINISTRATION	
<i>British Railways (Midland Region.)</i>	Tests of stability. Trend of future ideas.
<i>Great Indian Peninsula Railway</i>	Tests of stability. Trend of future ideas.
<i>South African Railway.</i>	Tests of stability. Trend of future ideas.
<i>New Zealand Government Railways.</i>	Tests of stability. Trend of future ideas.

62. Have you any special remarks to make?

62. No special remarks.

ADMINISTRATION	
<i>British Railways (Midland Region.)</i>	Axle boxes. Motor position.
<i>Great Indian Peninsula Railway.</i>	Axle boxes. Motor position.
<i>South African Railway.</i>	Axle boxes. Motor position.
<i>New Zealand Government Railways.</i>	Axle boxes. Motor position

rail? What are the results of these tests? Methods of measuring.
or add such calculations or results of tests to your reply?

Type of vehicle		
Electric locomotives	Diesel electric locomotives	Multiple unit electric motor cars
Not completed.		
None. xle double bogie type locos are order and their performance ll be noted for the future.		
See reply to Question 22. rience with articulated locomotive bogies has indicated that this arrangement has serious disadvantages regards « nosing » and lateral oscillation of the bogies at speed. ture designs it is probable that the non-articulated bogie with some form of bolster will be employed. awbar pull will be transmitted from the independent bogies to the underframe and thence by couplers ached to the end of the locomotive underframe.		
<i>Eo and Ec class locos.</i> sidered conversion to swing bolster type.	Only qualitative tests have been made.	To keep the simple type of drive on bogies which has proved satis- factory for prevailing speeds and conditions.

Would you prefer from the point of view of bogie construction and of its maintenance to have inside or outside
boxes? Why?
Do you consider that the motor should be placed as low as possible or above the level of the motor axle?

Type of vehicle		
Electric locomotives	Diesel electric locomotives	Multiple unit electric motor cars
	Outside for greater accessibility and more space for motors and gears.	
Outside. — Easily accessible	As high as possible due to flooding.	Outside.
Outside boxes. — Due to narrow gauge (1 068 mm). As low as possible for stability.		
Outside boxes. — Due to narrow gauge (1 068 mm). As low as possible. — Due to lack of head room.		

65. Number of vehicles using this type of bogie :

a) Locomotives, goods, passenger.

b) Electric motor cars.

c) Diesel electric rail cars.

66. Types of motor bogie.

ADMINISTRATION	
<i>British Railways (Midland Region).</i>	No. of vehicles using bogie. No. of types of motor bogie. Axle arrangement. Diameter of wheels. Max. weight per axle. Axle spacing. Distance between centre plates.
<i>Great Indian Peninsula Railway.</i>	No. of vehicles using bogie. No. of types of motor bogie. Axle arrangement. Diameter of wheels. Max. weight per axle. Axle spacing. Distance between centre plates.
<i>South African Railways.</i>	No. of vehicles using bogie. No. of types of motor bogie. Axle arrangement. Diameter of wheels. Max. weight per axle. Axle spacing. Distance between bogie centre plates.
<i>New Zealand Government Railways.</i>	No. of vehicles using bogie. No. of types of motor bogies. Axle arrangement. Diameter of wheels. Max. weight per axle. Axle spacing. Distance between bogie centre plates.

1. Number of non-motored and motored axles of a bogie.

3. Diameters of the wheels.

9. Weight per axle.

0. Spacing of axles.

1. Distance between bogie centre plates.

Type of vehicle		
Electric locomotives.	Diesel electric locomotives	Multiple unit electric motor cars
	2 1 Co 1 068 mm. 21 350 kg Centre axle offset 51 mm towards centre of locomotive. 10.9 m	
Passenger. 22 2 Ao — 1 1 092 mm 6 850 kg 2.75 m —	Freight. 41 1 — — — —	53 motors. 153 trailers. 1 Bo 1 092 mm 4 300 kg 3.05 m 11.6 m
Class 1E 187 1 Bo 1 240 mm 16 750 kg 2.82 m 6.65 m	Class 3E 28 1 Co 1 240 mm 18 900 kg 2.3 m 9.1 m	268 1 Bo 1 040 mm 12 500 kg 2.62 m 12.5 m
Eo 5 1 Bo 1 150 mm 12 500 kg 2.66 m 5.6 m	Ec 6 1 Bo 1 150 mm 12 500 kg 2.82 m 5.7 m	Ed 7 1 Do — — —
		6 1 Bo 915 mm 12 800 kg 2.36 m 13.2 m

72. *With or without a centering device.*
73. *With or without swing or other bolster.*
74. *With or without an anti-nosing arrangement.*
75. *With or without an anti-weight transfer device.*

ADMINISTRATION	
<i>British Railways (Midland Region).</i>	Centering device. Swing or other bolster. Anti-nosing device. Anti-weight transfer device. Coupling in lateral plane. Shock absorbers.
<i>Great Indian Peninsula Railway.</i>	Centering device. Swing or other bolster. Anti-nosing device. Anti-weight transfer device. Coupling in lateral plane. Shock absorbers : a) Vertical. b) Longitudinal. c) Transverse.
<i>South African Railway.</i>	Centering device. Swing or other bolster. Anti-nosing device. Anti-weight transfer device. Coupling in lateral plane. Shock absorbers : a) Vertical. b) Longitudinal. c) Transverse.
<i>New Zealand Government Railway.</i>	Centering device. Swing or other bolster. Anti-nosing arrangement. Anti-weight transfer device. Coupling in lateral plane. Shock absorbers.

76. *With or without coupling of bogies in the lateral plane.*

77. *With or without shock absorbers (or rebound dampers) for vertical movements.*

With or without shock absorbers (or rebound dampers) for longitudinal movements.

With or without shock absorbers (or rebound dampers) for transverse movements.

Type of vehicle		
Electric locomotives	Diesel electric locomotives	Multiple unit electric motor cars
	Without. Swing bolster. With side control springs. With equalising beams. Without. None.	
<i>Passenger.</i> Without. Without. Bogie control springs. Without. Without. Without. Without. Without.		Without. Swing bolster. Without. Without. Without. With. Without. Without.
Without. Without. Without. Compensated spring gear. With. Without. Without. Without.		Without. Swing bolster. Without. Without. Without. Without. Without. Without.
Without. Without. Without. Without. Spring compensation. has been removed. With. None.		Without. Swing bolster. Without. Without. Without. None.

78. *Construction of the frame (plate, rolled sections, box cast or other).*
 79. *Best angle for the transverse suspension links of the bolster for each type of bogie.*
 80. *Means of restriction of and lateral movement permitted between the body and the bogie.*

ADMINISTRATION	
<i>British Railways (Midland Region).</i>	<p>Construction of bogie. Best angle for bolster links. Method of restraining lateral movement. Suspension and support of body.</p> <p>Axleboxes.</p>
<i>Great Indian Peninsula Railway.</i>	<p>Construction of bogie. Best angle for bolster links. Method of restraining lateral movement. Suspension of body. Support of body on bogie. Axleboxes.</p>
<i>South African Railways.</i>	<p>Construction of bogie. Best angle for bolster links. Method of restraining lateral movement. Suspension of body.</p> <p>Support of body on bogie.</p> <p>Axleboxes.</p>
<i>New Zealand Government Railway.</i>	<p>Construction of bogie. Best angle for bolster links. Method of restraining lateral movement. Suspension of body. Support of body on bogie. Axleboxes.</p>

Suspension of the body on the bogie (connection).

Type of support of the body on the bogie.

Axleboxes (roller, plain bearing).

Type of vehicle		
Electric locomotives	Diesel electric locomotives	Multiple unit electric motor cars
	<p>Fabricated plate. 1 in 6. Rubber stops between bolster and bogie frame after 2.5 cm. Four bearing pads on two bolsters. Drive taken through circular sleeve in centre of spider linking bolsters and carrying bearing pads. Roller.</p>	
<p>Plate. — — See question 102. See Question 102. Plain.</p>		<p>Plate. 1 in 6 — Swing link suspension. King pin and side bearers. Plain.</p>
<p>Plate and rolled section. — No lateral movement allowed. Safety clip brackets on side steady bearers. Bogie centre bearing. Early locos — spherical. Latest locos — flat. Early locos — plain. Latest locos roller.</p>		<p>Plate and rolled section. Vertical. Rubber pads on inside of bogie sole bar. Bolster swing links. Flat oil bath centre bearing. Roller.</p>
<p>Plate and rolled section riveted. — Bogie centre casting and king pin. Solid bolster. Bogie centre bearing. Plain.</p>	<p>(Note : Welded bogies originally supplied failed.)</p>	<p>Plate and rolled section riveted. 1 in 18 to 1 in 11. Rubber bolster end pads. Swing links. Bogie centre bearing. Roller.</p>

84. a) *What is the material used for the axle?*
 b) *What is the interference on the axle seats?*
 c) *Have you had axle or wheel fractures due to the drive or to the factors a) or b) above?*

ADMINISTRATION	
<i>British Railways (Midland Region).</i>	Axle material. Interference. Cause of fracture.
<i>Great Indian Peninsula Raylway.</i>	Axle material. Interference. Cause of fracture.
<i>South African Railways.</i>	Axe material. Interference. Cause of fracture.
<i>New Zealand Government Railway.</i>	Axle material. Interference. Cause of fracture.

Type of vehicle		
Electric locomotives	Diesel electric locomotives	Multiple unit electric motor cars
	Medium carbon steel. 5 800 — 6 650 kg per sq. cm. 3 900 — 4 700 kg per cm of axle diameter. —	
	— — —	
B. S. report No. 24, Pt. 1. Specification No. 2/1928. 00 — 5 500 kg per sq. cm of axle diameter. of 1st locos. L.C, Broke at gear wheel seat. Overcome by increas- gear and wheel seat sizes.		See attached specification. CME 2/1939. .015 — .025 mm/cm diameter. —
and Ec S. report 24, Part 1. 4 000 — 68 000 kg. Total Supertough mang- anese molybdenum. A few fatigue failures of axles.		B. S. report 24, part 1, spec. 2. 3 900 kg per cm of wheel seat. A few fatigues failures of axles.

ATTACHMENT TO
QUESTION 84.
No. C. M. E. 2/1939.

South African Railways and Harbours (Mechanical Department).
SPECIFICATION FOR CARRIAGE AND WAGON AXLES, TYRES AND WHEELS
WITH AXLES COMPLETE.

1. — The wheels shall be manufactured by makers whose names appear on the Administration's list of approved makers, and as regards dimensions, these are to be in accordance with those shown on the drawings mentioned in the schedule. Disc centres with Gibson ring fastenings or solid wheels of the Schoen type are preferred. If spoke centres are used, Gibson retaining rings are to be supplied. Stud fastenings are prohibited (see Specification C. M. E. 5/1936 for rolled steel centres).

2. — The axles and tyres are to be made from the best quality open hearth acid steel by manufacturers whose names appear on the Administration's list of approved makers, and shall not show on analysis more than 0.05 per cent of sulphur or of phosphorus for axles, not more than 0.4 per cent for tyres, and to stand the tests hereinafter referred to.

3. — The tyres, after being bored to gauge, are to be carefully and uniformly heated and shrunk on to the wheel centres and secured by retaining rings as shown on the drawing. A shrinkage allowance of $1/64$ of an inch per foot of diameter of wheel centre is to be allowed on the tyres.

4. — For axles over $4\frac{1}{2}$ " diameter in the wheel seat, the wheel centres are to be forced on to the axles by hydraulic pressure of not less than 10 tons or more than 14 tons per inch diameter of wheel seat and before the tyres are shrunk on. For axles with $4\frac{1}{2}$ " diameter wheel seat or less, the hydraulic pressure is not to be less than 8 tons and not more than 10 tons per inch diameter of wheel seat.

5. — The journals are to be carefully turned to the required dimensions, afterwards burnished with a three roller burnisher and finished off clean and smooth. Grinding instead of burnishing will be acceptable.

6. — The journals are to be covered with protective material of an approved brand and close lagged with wood strips held in position by strong hoop iron or wire.

7. — Each complete pair of wheels and its axle will be examined and gauged by the Inspector.

Axles.

8. — At least one axle out of every charge or one in every fifty, if there be more than that number in the charge taken at random, shall be subjected to the tests prescribed in British Standard Report No. 24, Part 1, Specification No. 3/1928. All axles shall be oil treated. The conditions of this Specification shall apply throughout unless altered or added to by these instructions.

9. — In cases where the length of the axles under test does not admit of the distance between supports being adhered to, the distance between the points of support shall be as great as possible.

10. — Axles of complete wheels are to be turned and smooth finished except for the portion between the wheels which may be either (a) left black, provided the forging is clean and true and conforms to clause 11A, or (b) turned and smooth finished to the dimensions given on drawing. Any axle showing the slightest surface defect in any part or tool mark in the finished portion will be rejected. Grinding is acceptable.

11. — Separate axles unless otherwise specified are to be rough turned with the exception of (1) the ends which are to be finished to the length given (2) the portion between the wheels. The latter part may be either (a) left black, provided the forging is clean and true and conforms to clause 11A, or (b) turned and smooth-finished to the dimensions given on the drawing. Any axle showing the slightest surface defect in any part or tool mark in the finished portion will be rejected. Grinding is acceptable.

11A. — For axles of complete wheels and for separate axles, which have the portion between the wheel seats left black; forging tolerances within the limit of minus 0 and plus $1/8$ in. should be allowed on the understanding that the black portion should not run more than $1/2$ in. out of thruth when placed between centres.

12. — For the purpose of analysis, tested axles must be drilled in the presence of the inspector, and the sample put in a packet, closed, sealed and addressed to the Advisory Engineer, High Commissioner's Office, London, and handed in at the Post Office by the Inspector.

13. — The axles are each to be guaranteed by the Contractors to run for six years. The maker's name, contract or order number, type of axle and cast number are to be stamped on the chamfered portion of the collar of the axle or on the end of the axle, as maybe specified. These particulars are to appear at one end only of each axle; no marking whatever is to be done on the body of the axle. Any axle which in the opinion of the Chief Mechanical Engineer shows any defect before it has run the guaranteed period, is to be replaced at the Contractor's expense by another axle of the same type under the same guarantee. Alternatively the Administration may be reimbursed for the price of a new axle including freight and insurance to South Africa.

Tyres.

14. — The tyres shall be manufactured from the highest quality of steel ingots of a length and weight to produce, after sufficient discard has been taken off, two or more blanks from each ingot. The ingots shall be made from the best selected material by the acid open hearth process in accordance with British Standard Report No. 24, Part 2 Specification No.5 -1928, and addenda dated December 1930, and the tyres shall not show on analysis more than 0.04 per cent of sulphur or of phosphorus. Tyres of the highest tensile allowed are to be supplied, viz., class E.63 to 69 tons per square inch. Tenderers must specify the type of ingot that they propose to use. All tyres are to be drop tested in accordance with clause 8 of British Standard Specification above-mentioned.

15. — For the purpose of analysis, tested tyres must be drilled in the presence of the Inspector and the drillings be put in a packet, closed, sealed, and addressed to the Advisory Engineer, High Commissioner's, London, and handed in at the Post Office by the Inspector.

16. — The tyres are to be stamped on the outer face with the cast number, the maker's name, contract or order No., date of manufacture, the letters S. A. R. S. A. S., and type number as shown on drawing.

Tests for spokes.

17. — When spoke centres are approved, the iron from which the spokes are made must be capable of standing a tensile strain of from 22 to 23 tons per square inch, with an elongation of at least 30 per cent in 8 inches and a contraction of area at the point of fracture, of not less than 30 per cent.

18. — Pieces of the iron must also be capable of being bent cold round a bar equal to twice their own thickness until the ends meet without exhibiting any sign of fracture.

Tyre fastening rings.

19. — Tyre fastening rings of all kind, unless otherwise specified, are to be made from steel material in accordance with Standard Specification No. C. M. E. 9/1938, for symbol 7 steel.

Works analysis.

20. — A correct copy of the Works Analysis (including the elements chrome and nickel, if used) of each charge represented by the axles and tyres tested, must be handed to the Inspector to be forwarded to the Advisory Engineer with is report.

85. *What is the method of suspension of the bogie frame on the wheels?*

86. *What are the characteristics, the deflection in cm/T (tonne) and the maximum deflection of the :
Laminated springs.
Volute springs.*

ADMINISTRATION	
<i>British Railways (Midland Region).</i>	Suspension of bogie frame on wheels. Axleboxes.
<i>Great Indian Peninsula Railway.</i>	Suspension of bogie frame on wheels. Axleboxes.
<i>South African Railways.</i>	Suspension of bogie frame on wheels. Axleboxes.
<i>New Zealand Government Railways.</i>	Suspension of bogie frame on wheels. Axleboxes.

86. *What are the characteristics, the deflection in cm/t (tonnes) and maximum deflection of the springs?*

British Railways (London Midland Region). — Diesel electric locomotives.

	Maximum deflection	Modulus
Laminated springs	6.14 cm	.5812 cm/tonne
Coil springs	10.63 cm	.889 cm/tonne

Great Indian Peninsula Railway.

Passenger locomotive.

	Modulus
Laminated driving wheel springs. . . . .	.32 cm/tonne
Bogie laminated springs.775 cm/tonne

Freight locomotive.

Laminated springs338 cm/tonne
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Multiple units.

Laminated springs896 cm/tonne
Auxiliary coil springs	1.51 cm/tonne

il springs.
 bber blocks. Shock absorbers (or rebound dampers).
 Type of axleboxes and type of guides.

Type of vehicle		
Electric locomotives	Diesel electric locomotives	Multiple unit electric motor cars
	Coil springs and equalising beams. Roller bearing with manganese steel guides.	
Laminated sidesprings and coil auxiliary springs. Outside type with phosphor bronze guides.		Laminated side springs and coil auxiliary springs. Outside type with heavy duty cast iron guides.
Semi-elliptical side springs and auxiliary coil springs acting on equalising beams. Cast steel with bronze liners. Latest type 10% — 14% manganese steel liners.		Semi-elliptical side springs. Cast steel with bronze liners. (In future liners will be of manganese steel).
Laminated springs with rubber pads on hangers. Plain bearings. (The liner is not renewable.)		Laminated springs with rubber pads on hanger. Roller bearing with manganese steel liners.

South African Railways.

Electric locomotives.

	Maximum deflection	Modulus
Laminated springs	5 — 6 cm (working)	1.04 cm/tonne
Helical (coil) springs	3.8 cm	.54 cm/tonne

Multiple units.

Laminated springs	6 cm	.938 cm/tonne
Coil springs	9 cm	.8193 cm/tonne

New Zealand Government Railways.

« Eo » locos.

	Maximum deflection	Modulus
Laminated springs	3.2 cm	.63/tonnes

« Ed » locos.

Laminated : a) Bogie58 cm/tonne
b) Pony.427 cm/tonne
c) Driving.45 cm/tonne

Coil (quill)	2.13 cm/tonnes
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88. *Initial play between the guides and the axleboxes.*

89. *Maximum play between the guides and the axleboxes.*

90. *Initial lateral play of the motor axles (mm).*

ADMINISTRATION	
<i>British Railways (Midland Region).</i>	Axlebox play : <i>a)</i> initially; <i>b)</i> maximum. Lateral play of axle : <i>a)</i> initially; <i>b)</i> maximum. Flexible connections.
<i>Great Indian Peninsula Railway.</i>	Axlebox play <i>a)</i> initially; <i>b)</i> maximum. Lateral play of axle : <i>a)</i> initially; <i>b)</i> maximum. Flexible connections.
<i>South African Railways.</i>	Axlebox play : <i>a)</i> initially; <i>b)</i> maximum. Lateral play of axle : <i>a)</i> initially; <i>b)</i> maximum. Flexible connections.
<i>New Zealand Government Railways.</i>	Axlebox play <i>a)</i> initially; <i>b)</i> maximum. Lateral play of axle : <i>a)</i> initially.; <i>b)</i> maximum. Flexible connections.

Maximum lateral play of the motor axles (mm).

Do you use flexible connection between the axles and the axleboxes or between the bearings and the axleboxes?

If so, would you give particulars from the point of view of the elasticity as well as a concise description.

Type of vehicle		
Electric locomotives	Diesel electric locomotives	Multiple unit electric locomotives
	3.2 mm. spring controlled.	
	.8 mm.	
	.8 mm.	
	—	
.4 mm.		1.5 mm.
.8 mm.		3 mm.
1.2 mm.		3 mm.
8.0 mm.		8 mm.
None.		None.
3 mm (total)		8 mm (total)
Not specified.		Not specified.
4.5 mm (total)		4.5 mm (total)
— None.		— None.
4.75 mm.		3 mm.
—		—
6.25 mm (total)		4.5 mm (total)
—		—
None.		None.

93. *Effect of the play of the axles on good riding.*

94. *Possible effect of the intermediate and rear axles on the axle ahead from the point of view of the force between rail and wheel.*

ADMINISTRATION	
<i>British Railways (Midland Region).</i>	Effect of axle play. Effect of intermediate and rear axles. Advantages of : a) Compensating device.
<i>Great Indian Peninsula Railway.</i>	Effect of axle play. Effect of transverse coupling. Advantages of : a) Centering device.
<i>South African Railways.</i>	Effect of axle play. Effect of intermediate and rear axles. Effect of transverse coupling. Advantages of : a) Anti-nosing arrangement; b) Compensating device; c) Coupling in lateral plane.
<i>New Zealand Government Railways.</i>	Effect of axle play. Advantages of : a) Bolster.

95. *Particulars of the connections between bogies.*

96. *Effect of the transverse coupling between bogies on the flange wear and on the riding of the vehicles at the termination of curves.*

Type of vehicle		
Electric locomotives	Diesel electric locomotives	Multiple unit electric motor cars
	<p>—</p> <p>No information.</p> <p>—</p> <p>Prevents undue weight transfer.</p>	
<p>Instability results if clearance of axle box exceeds 8 mm in axle.</p> <p>Bogie and pony control springs have a very good effect on riding properties.</p>		<p>Can contribute to bad riding.</p> <p>2 bogies of this type have been tried and tyre wear was reduced at the radius and flange.</p>
<p>Not serious unless excessive.</p> <p>Side thrust is greater with a three axle bogie than a two axle bogie. The increase is due to leading wheels skidding intermediate wheels about the rear wheels. With no side play this can cause high stresses in track and bogie. Uncontrolled side play causes nosing and oscillation of the bogies. Experiments with controlled side play are now being conducted.</p> <p>Experience has shown that some such device will have to be fitted.</p> <p>The present arrangement of compensation is satisfactory (not <i>cross</i> compensated).</p> <p>Free relative movement is considered preferable if lateral oscillation can be prevented.</p>		<p>Can be critical.</p>
<p>Increased nosing.</p> <p>Solid bolster type is very susceptible to track irregularities.</p>		<p>Increased nosing.</p> <p>Improves riding.</p>

98. *Have you vehicles with motor bogies with three axles?
What experience have you got with these bogies.
A general arrangement drawing of the construction.*

ADMINISTRATION	
<i>British Railways (Midland Region).</i>	Experience of 3 axle bogies. Experience of 3 bogie vehicles.
<i>Great Indian Peninsula Railway.</i>	Experience of 3 axle and 3 bogie vehicles.
<i>South African Railways.</i>	Experience of 3 axle bogies.
<i>New Zealand Government Railways.</i>	Experience of 3 bogie vehicles.

100. *Arrangement for avoiding wheel spin.*
101. *Arrangements for giving warning of the commencement of wheel spin.*

ADMINISTRATION	
<i>British Railways (Midland Region).</i>	Avoidance of wheel spin. Indicating device.
<i>Great Indian Peninsula Railway.</i>	Avoidance of wheel spin. Indicating device.
<i>South African Railways.</i>	Avoidance of wheel spin. Indicating device.
<i>New Zealand Government Railway.</i>	Avoidance of wheel spin. Indicating devices.

ve you vehicles with three bogies or more and what is your experience in this regard?
General arrangement drawing of the construction.

Type of vehicle.		
Electric locomotives	Diesel electric locomotives	Multiple unit electric motor cars
	Insufficient to draw conclusions. None.	
passenger locos of 6 axle double bogie construction on order.		
Insufficient to draw conclusions. (Drawing CE 7, 8 and 9/15626).		
Locos of 3 bogie construction on order. (Drawing S. 1530 B-Q. 6.)		

Type of vehicle		
Electric locomotives	Diesel electric locomotives	Multiple unit electric motor cars
	None. Voltmeters across traction motor fields.	
Sanding gear. None.		None. None.
None. None.		None. None.
None.		None.

102. *Describe in detail the arrangements designed to ease the entry into curves as well as for damping undesirable movement of the vehicle when running.*

British Railways (London Midland Region). — Diesel electric locomotives.

Spring side control between axle boxes and guides and a spring controlled swing bolster serves to aid good riding and easy entry into curves. The combination of coil and laminated springs in the body suspension has resulted in no undesirable vehicle movement.

Great Indian Peninsula Railway. — Passenger locomotives.

Provided with 4 wheel truck at one end and a «Java» truck on the other. The bogie is centrally pivoted with 2 side bearer plates. The pivot is hemi-spherical steel fitting into a bronze bush, the underside of which is serrated and mates with the transverse serrations on the bogie. The movement of this bush is controlled by two lateral control springs of volute form connected by «V» shape levers.

The «Java» truck is provided with a king pin over the pony axle with side bearer pillars of steel, fitting into bronze shoes free to slide along a radial path. The king pin engages with the slide block whose movement is controlled by a pair of laminated springs coupled in series.

South African Railways.

New Zealand Government Railways.

103. *Results in service of the various types of bogie giving all possible information concerning failures assignable to the bogies and to their suspension. Measures taken to avoid their recurrence.*

British Railways (London Midland Region).

Great Indian Peninsula Railway.

Electric locomotives.

The running quality of all Passenger engines is excellent at all speeds up to 70 m.p.h. As long as the thrust face clearances of the carrying wheels are kept within the prescribed limit of $5/16''$, it is seldom necessary to adjust the control springs. In spite of articulated construction of the freight engines and the jack shaft drive, these engines ride remarkably well even at the prescribed maximum speed of 35 m.p.h.

Multiple units.

The riding and running stability of motor coaches caused a considerable amount of concern and a special Committee was appointed to investigate the causes which led to hunting and nosing of the coaches and abnormal wear of the rails. On the recommendations of this Committee certain alterations were carried out which are briefly described below :

- (i) Laminated bearing springs were made more flexible and the construction has been altered as follows :

Original — 12 plates $4'' \times 9/16''$.

Present — 13 plates $4'' \times 5/8''$.

Also India Rubber auxiliary rubber springs were changed to helical springs and the eye bolts were shortened by 1.1/2" to suit these springs.

(ii) Phosphor bronze liners on the swing links were replaced by heavy duty cast iron and similarly manganese steel liners replaced by mild steel liners. This change reduced excessive wear of liners.

(iii) To reduce heavy wear on horn cheek blocks the existing liners of phosphor bronze were replaced by heavy duty cast iron. The axlebox liners were also changed over from mild steel to manganese steel.

(iv) The end play on the traction motor suspension brasses for the motors was increased from 1/16" to 3/8".

(v) Nose suspension bracket springs have been modified to a more flexible design.

(vi) A smoother transition is now obtained by regrouping the motors and this has removed the jolting during transition. Briefly the main causes of rough riding were (a) Excessive clearance on bolster rubbing blocks and swing link brackets liners : (b) excessive clearance between axle box and horn check block (c) poor quality of springs : (d) lack of resilience in the auxiliary bearing springs : (e) rigidity of the motor frame on the axle and (f) poor condition of track.

South African Railways.

New Zealand Government Railways.

« Eo » class locomotives.

Excessive spring hanger failures were at one time a source of trouble on these locomotives, the average number of replacements being 92 per year. These bogies utilised compensated spring gear and at some time in their life had been fitted with spherical bogie centres. This combination rendered the bogie frames unstable. The fault was corrected by retaining the spherical bogie centres, locking the compensating gear solid and fitting rubber auxiliary springs to the spring hangers. Subsequent failures of hangers. — Nil.

« Ec » and « Ed » class locomotives.

No frame failures.

Multiple unit stock.

Failure have been confined to the original welded bogies. These were overcome by strengthening and using riveted construction in place of welding.

104. *Comparison of the costs of maintenance of the different types of bogie. Do the results obtained justify the first cost and cost of maintenance?*

British Railways (London Midland Region).

Great Indian Peninsula Railway.

Passenger locomotives.

This is an excellent drive, the only source of trouble being the quill bearings. These have to be changed about every 50 000 miles. Fortunately this is easily accessible.

Freight locomotives.

Jack shaft bearings gave a lot of trouble in the beginning, average mileage then being 10 000 miles. With modified bearing the oil consumption has been drastically reduced and the average mileage has come up to 50 000 miles. Conversion to solid big end bearings has also helped in that direction. Breakage of double cantilever springs is another source of trouble but the life has been considerably increased by using ground leaves for lamination. Accurate setting of wedges for jack shafts bearings is obtained by gauges. This has increased the life of these bearings.

Multiple unit stock.

There is not much maintenance in service. Oiling of suspension bearings is done every 15 days and 2 lbs. of grease is added to the gear case every two months.

South African Railways.**New Zealand Government Railways.**

No bogie maintenance costs have been separately kept.

SECTION C. — BOGIES.

British Railways (Eastern Region).

	Tyneside stock	Liverpool street-Shenfield
43. Name and type of bogie	Single bolster.	Single bolster.
44. No. of vehicles :	71	92
Commencing year	1937	1949
Axle arrangement	See drawing.	Bo — Bo
45. Types under construction	None.	None.
47. Motor connections	Series.	Series.
48. One hour torque	—	—
49. Maintenance work :		
Inspection	3-daily.	3-daily.
Examination	3-weekly	25 and 50-daily.
Overhaul	Yearly.	Yearly.
Heavy overhaul	4-yearly.	4-yearly.
50. Horizontal forces	Unknown.	Unknown.
51. Transverse play of axle	5 mm.	4 mm.
52. Angular play of axle	0° 5' (total).	—
54. Results with bogies	Good if adequately maintained.	
55. Riding of vehicles :		
C. M. E. Department	Riding of motor coaches is not as good as that of trailers.	
56. P. W. Department	Satisfactory.	Not yet determined.
57. Effect of wheel diameter	Not known.	Not known.
58. Determination of wheel diameter	—	—
59. Tests of stability	None.	None.
61. Future trends	Towards latest stock (Liverpool street to Shenfield).	
63. Axleboxes	Outside boxes for accessibility.	
64. Motor position	Axle level.	Axle level.
65. No. of vehicles using bogie	71	92

	Tyneside stock	Liverpool street-Shenfield
66. Types of motor bogie	See drawings — Question 46.	
67. Axle arrangement	Bo.	Bo.
68. Wheel diameter	914 mm.	1 092 mm.
69. Max. weight per axle	9 000 kg.	11 000 kg.
70. Axle spacing	—	2.55 m.
71. Distance between bogie centre plates.	—	—
72. With or without centering device .	Without.	Without.
73. With or without swing or other bolster	Swing bolster.	Swing bolster.
74. With or without anti-nosing arrangement	Without.	Without.
75. With or without anti-weight transfer device	Without.	Without.
76. With or without coupling of bogies in the lateral plane	Without.	Without.
77. With or without shock absorbers	Without.	Without.
78. Construction of bogie		Motor — Plate and rolled sections. Trailer — Pressings. 1 in 8.
79. Best angle for bolster links . . .	—	Rubber stop. 6 cm. total play.
80. Restriction of lateral movement. .		Centre pin in centre casting.
81. Suspension of body	Centre casting and side friction blocks.	Centre casting and side friction blocks.
82. Support of body	White metal	White metal.
83. Axleboxes	B. S. S. No. 3, report 24 — 1 and L. N. E. R. Specification No. 4.	
84. a) Axles	—	—
b) Interference	—	—
c) Fractures	—	—
85. Support of bogie	Laminated springs.	Laminated springs.
86. Spring characteristics	<i>Modulus</i> <i>Total defl.</i>	<i>Modulus</i> <i>Total defl.</i>
Motor bogies		
Laminated	1.3 cm/t 1.46 cm	1.023 cm/t 2.07 cm.
Bolster spring (per nest of 2) . .	.5 cm/t 1 125 cm.	.469 cm/t .952 cm.
87.	See drawings attached.	
88. Axlebox play :		
Transverse : a) Initially	1.6 mm.	1.6 mm.
89. b) Maximum	Not specified.	Not specified.
90. Lateral play of axles :		
a) Initially	4.7 mm.	2.5 mm.
b) Maximum	Not specified.	Not specified.
92. Flexible connections	Not used.	Not used.
93. Effect of axle play		No adverse effect within tolerance.
94.		
95.		
96.	No experience.	
97.		
98.		
99.		
100. Avoidance of wheel spin	Sanding.	Sanding.
101. Indicators	None.	None.
102. Failures		
103.	No failures experienced.	

L. N. E. R. Specification No. 44.
(Revised December 1947)

SPECIFICATION FOR CARRIAGE WHEELS AND AXLES OTHER THAN THOSE WITH ROLLER BEARINGS.

To be supplied to the
LONDON AND NORTH EASTERN RAILWAY.

General.

The components entering into the construction of the finished wheels and axles to be obtained from manufacturers approved by the Chief Mechanical Engineer, and to be in accordance with the Specification attached hereto.

The wheels and axles to be in accordance with drawings and to gauge at all principal dimensions. Gauges and templates used to be submitted to and approved by the Chief Mechanical Engineer or his representatives.

Axles.

The axles to be smooth turned all over to the prescribed dimensions and finish, and to have counter-sunk drilled lathe centres. Any axles in which seams or other defects are revealed on machining to be rejected. The wheel seats to be smoothly turned or ground with a maximum ovality of .001 in. and may be either parallel or conical. If conical the smallest end of the cone must be nearest to the journal and the difference in diameter between the small and large ends of the cone taken over the length of the wheel fit, must not exceed .003 in. The journals are to be smoothly machined or ground, truly circular within .001 in., parallel within .002 in. The journal diameter may vary from drawing size to .005 in. large, subject to each journal conforming to the limits of accuracy given above.

The length of the journal may vary from the drawing size to .005 in. long.

After machining or grinding, the journals must be burnished with hardened steel rollers. The dust shield collar to be polished.

Tyres.

The tyres to be smoothly bored out with a shrinkage allowance of one-eight-hundredth of the internal diameter. The groove for the retaining ring to be carefully put in with the appropriate radii in the top corners.

Wheel centres.

The wheel centres to be smoothly bored out with allowance for pressing on the axle, and turned to specified dimensions on boss and rim.

Assembly.

The tyres to be shrunk on the wheels at a low heat by uniformly heating them all round just enough to allow them to pass over the rim. The tyre to be allowed to cool in the air, water not being used. The edge of the tyre to be closed down on to the retaining ring carefully, and preferably by rolling. The tyres to be turned on treads and flanges exact to standard profile and skimmed up to a true surface on the faces.

The hole in the boss and the axle wheel seat to be coated with pure rape oil as lubricant, and the wheel forced on to its seat by hydraulic power with a pressure of not less than 10 or more than 13 tons per inch diameter of wheel seat, the required pressure being obtained

when the wheel centre is at least half an inch from home. The press to be fitted with an approved automatic recorder, and the records, numbered to correspond with the wheels, after being submitted to the Railway Company's Inspector, and, if considered satisfactory, after being signed and dated by him, to be forwarded to the Company's Works, to which the wheels and axles are to be sent. Each pair of finished wheels must be subjected to a back pressure test of not less than 50 tons and not more than 55 tons without moving either wheel.

The finished wheels and axles to be stamped on the inside of each wheel boss with the maker's name and the wheel record number. The pressure in tons at which each wheel was pressed on to be stamped on the ends of the axle, together with a progressive number which will be supplied; the latter «T» must also be stamped on each end after the wheels have satisfactorily passed the back pressure test.

Test of finished wheels and axles.

Each pair of finished wheels and axles is to be spun between centres and the following deviations from concentricity will be allowed. These deviations are to be measured by the travel of the pointer of a fixed clock gauge during one complete revolution of the pair between centres.

Axle journals : maximum travel of clock gauge .002 in.

Tyre tread : maximum travel of clock gauge .010 in.

Tyre inside face : maximum travel of clock gauge .015 in.

A record to be taken by the makers of all wheels tested, and particulars of all inaccuracies of turning on journals and wheels to be supplied for all wheels delivered.

Each pair of finished wheels and axles to be tested for dynamic balance on an approved machine capable of detecting in each wheel an unbalanced moment of 32 inch ounces. During this test the wheel pair must be run at a speed which coincides with the resonance of the spring-mounting of the balancing machine. Any unbalance found may be corrected by the fixing of a counterweight not exceeding 4 lbs. at 16 in. radius on the web of each wheel. After this correction the residual unbalanced moment in each wheel must not exceed 32 inch ounces. Correction plates to be secured by two 3/8 in. set screws, riveted over centres at 16 in. radius. Correction plates of 4 ounces or under may be fixed by one set screw riveted over. Each pair of wheels must be in balance within the limit given above at all speeds up to 750 r.p.m.

Painting.

If between machining, inspection and final painting, rust can form on the machined axles, a temporary anti-corrosive composition should be applied and continuously maintained until the axles are painted.

After the wheels and axles have been finally inspected by the Railway Company's Inspector, the centre portion of the axle must be painted with two coats of L. N. E. R. Mixture No. 1 Bauxite Red Body Paint, the centres with L. N. E. R. Mixture No. 1 Bauxite Red Body Paint and the outer faces of the tyres white.

The journals to be covered with white lead and suitably protected with rope or wood laggings.

Access to work.

The Railway Company's Inspector shall have free access to the maker's works at all reasonable times; he shall be at liberty to inspect the manufacture at any stage, and reject any material that does not conform to the terms of this Specification.

Certificate.

On the completion of the inspection to the satisfaction of the Railway Company's Inspector, a certificate will be given for the material passed, and material must not be delivered until this certificate has been obtained. This must be forwarded with the invoice.

Inspection advice.

A written advice to be sent to the representative of the Purchasing Agent named on the order when material is ready for inspection, giving order numbers and particulars.

Replacement.

Any pair of wheels and axles found to be defective after delivery will be returned to the maker and replaced by him, notwithstanding that it may have passed the tests required by this Specification and been accepted by the Railway Company's Inspector.

INTERNATIONAL RAILWAY CONGRESS ASSOCIATION

15th. SESSION (ROME, 1950).

QUESTION X.

Drawing up the financial balances regarding passenger and goods services taking into account the prime cost of trains : per category, per line and per type of motive power.

Principles and methods of calculation.

REPORT

(Austria, Belgium and Colony, Bulgaria, Czechoslovakia, France and Colonies, Greece, Hungary, Italy, Luxemburg, Netherlands and Colonies, Poland, Portugal and Colonies, Rumania, Spain, Switzerland, Syria, Turkey and Yugoslavia.)

by R. DUGAS,

Directeur, Chef du Service Technique de la Direction Générale de la Société Nationale des Chemins de fer français.

In concluding his Report in 1947 to the Lucerne Session on the organisation of passenger train services, M. LORRIOT insisted on the need for drawing up a balance sheet for the passenger services showing the receipts and expenditure incurred by these services. He suggested that a special enquiry should be made on this point.

This led to the decision to include the question of preparing financial balance sheets for the passenger and goods services in the agenda for the 1950 Session.

Though the Railways find it easy to divide up the receipts amongst the passenger and goods traffic, the problem of dividing up the expenses is much more difficult to solve and necessitates a study of costs.

Thus during recent years several Administrations have found it necessary to study

their costs — in particular to enable them to prepare financial balance sheets for each category of traffic (passenger and goods) and to determine in this way what modifications should be made to the rates.

PREPARATION OF FINANCIAL BALANCE SHEETS.

1. Principles upon which the calculations are based.

Railway Administrations make use of different methods to determine their costs :

— *the Netherlands Railways* divide up those costs which can be directly attributed to one category of traffic or the other; in this way they divide up their total expenditure into :

- passenger traffic expenditure;
- goods traffic expenditure;
- general expenditure.
- the *Spanish and Portuguese State Railways (Mozambique Colony)* divide the total expenses between the passenger and goods traffic by arbitrary rules for all the expenditure which can be directly attributed to one category of traffic;
- finally the *Belgian (S. N. C. B.) and French (S. N. C. F.) Railways* divide up their costs between the different categories of trains, before determining the expenditure per category of traffic.
- fast and express railcars;
- through railcars;
- stopping railcars;
- suburban railcars;
- *Mail trains* :
 - through;
 - stopping.
- *Goods trains* :
 - through;
 - stopping;
 - trains composed of S. N. C. F. wagons;
 - trains composed of private wagons.

2. Dividing up the trains into categories.

The statistics of the *S. N. C. B.* have up to now distinguished between the different categories of trains as follows :

- *Passenger trains* :
 - steam trains;
 - Diesel rail motor coaches;
 - electric rail motor coaches.
- *Goods trains* :
 - only one category, all the trains being hauled by steam locomotives.

They are however considering breaking down the figures still further by adding the following categories :

- *Passenger trains* :
 - international trains;
 - through and semi-through trains;
 - stopping trains.
- *Goods trains* :
 - express;
 - through trains;
 - local trains.

The *S. N. C. F.* has divided its trains into 14 categories :

- *Passenger trains* :
 - fast and express trains;
 - through trains;
 - stopping trains;
 - suburban trains;

Certain categories are subdivided according to the method of traction :

- steam traction :
 - using coal;
 - using fuel oil;
- electric traction :
 - with locomotives;
 - with rail motor coaches;
- Diesel traction.

In actual fact, taking the subdivisions per method of traction into account, the trains are divided up into 44 categories.

3. Method of dividing up the costs.

The way the expenditure is ascertained depends upon the nature of the costs involved :

- directly;
- from statistical data, from enquiries, from official documents (staff roster, service tables, etc.);
- general rulings or « keys » laid down once and for all.

For the principal categories of expenditure, the following methods are used :

- *General management.*

In general the administrative costs relative to a given traffic are calculated directly, the remainder then being dealt with as follows :

- the *Netherlands Railways* do not divide up common expenditure;
- the *S. N. C. F.* and the *S. N. C. B.* divide them up proportionately to the expenditure under the other headings.
- the *Spanish Railways* divide them proportionally to the number of trains in each category, passenger and goods;
- the *Portuguese State Railways (Mozambique Colony)* divide them up amongst the different railways proportionately to the total expenditure of each system, the administrative costs of the systems being themselves divided up in proportion to the expenditure by the different Departments :
 - Operating;
 - Traction, depots and works;
 - Way and works.

— *Station staff :*

The *Netherlands Railways* divide the expenditure on station staff according to the service tables.

The *Spanish Railways* determine directly the number of men needed for each category of train (passenger and goods) and divide the non-specialist staff arbitrarily amongst the passenger and goods services.

On the *S. N. C. B.* the station staff costs are divided up amongst the categories of trains and categories of traffic according to definite coefficients based on the results of an enquiry carried out in all the stations on the system.

The real expenditure for one month is considered in the case of each station, according to the time taken for each kind of operation, for each category of staff, taking into account the average real wages of these employees.

When these expenses are regrouped it shows how the total cost of the station staff for the month checked can be divided up. These results are extrapolated to get the yearly figure.

On the *S. N. C. F.* the number of staff that can be attributed to each category of traffic is determined by an investigation covering as many stations as possible.

The remaining staff is then divided up amongst the categories of traffic, partly according to a formula, and partly from the results of the investigation.

The expenses are then divided up according to the number of employees.

— *Train staff :*

Inspection of the service documents makes it possible to divide up the staff of each category (inspectors, guards, conductors...) per category of traffic, and thereby ascertain the expenses according to the average wages of each category of staff.

— *Locomotive staff :*

Generally the following method of dividing up the expenses is adopted :

For each method of traction, the number of men is divided up amongst the different categories of trains according to the staff roster.

The expenses per category of traffic are ascertained from the number of crews needed and the average wage per crew (including traction and economy premiums, etc.).

The *Netherlands Railways* are of the opinion that dividing up the locomotive staff expenditure by means of the service tables comes up against serious difficulties when any permanent alterations are made to these tables. They consider that in principle it would be desirable to base such a division on an exact calculation of the working hours of the drivers, but that such a calculation would be very costly to make. Consequently they do not divide up the locomotive staff costs.

— *Shed staff.*

The *S. N. C. F.* keep an account of the shed staff costs per method of traction and then, for each method of traction, per series of locomotives. For each series of locomotives, the costs are then divided up per category of train in proportion to the train mileage.

In a similar way the *S. N. C. B.* divide up the shed staff costs separately for each type of steam locomotive in proportion to the

total mileage (including light running, and shunting) for each type for each category of train, and the average kilometric cost for this type. In the case of the electric rail motor coaches and the diesel, the costs are obtained directly from the accounts.

The *Spanish Railways* make a direct allocation of the shed staff costs between the passenger and goods trains.

The *Netherlands Railways* do not divide up the shed staff costs.

— *Traction fuel or current.*

On the *S. N. C. B.* the cost of coal is divided up in proportion to the consumption for each category of trains.

The latter are determined by the type of locomotive, according to the unit allocation attributable to this type and the work done for each category of trains, expressed in virtual T-km (unit of work of the locomotive corresponding to 5 000 kgm).

In addition light running and shunting the actual working hours, train heating, etc., are all taken into account.

On the *S. N. C. F.* the cost of coal or fuel oils are ascertained from the unit consumption per series of engines and the mileage of the different categories of trains hauled by each series of engines.

The cost of electric current is divided up according to the current consumption meters.

The *Netherlands Railways* simply divide up these costs in proportion to the train kilometres.

— *Maintenance and repair of the engines :*

The costs are ascertained from the average kilometric cost per series of engine and the mileage run by the different categories of trains.

However on the *S. N. C. B.* the maintenance costs are related to the complete cycle between two general overhauls; consequently they do not necessarily correspond to the actual expenditure during the year.

— *Maintenance and repair of the rolling stock.*

The accounts show the distribution of

the costs per category of rolling stock (coaches, vans, wagons); it is therefore an easy matter to allocate to each category of traffic the actual costs belonging to that category.

As in the case of the locomotives, the *S. N. C. B.* calculates the costs for maintaining the rolling stock for a complete cycle.

— *Inspection of the permanent way :*

These costs are divided up amongst the categories of trains according to the mileage by the *Spanish, Belgian (S. N. C. B.)* and *French (S. N. C. F.) Railways*.

The *Netherlands Railways* on the other hand consider that it is impossible to allocate them accurately and leave them as a whole.

— *Maintenance and renewal of the permanent way :*

On the *S. N. C. B.* part of the costs are allocated directly to each category of trains, and the remainder proportionately to the virtual T/km. The allocation of the costs for one and the same category between the trains of the different methods of traction is done on the same basis.

Corrections are made as in the case of the stock to take into account the permanent maintenance regime.

On the *S. N. C. F.* the costs of maintenance and renewal of the permanent way are divided up proportionately to the T. K. B. R., coefficients being used to take into account :

- the average weight of the locomotives;
- the running speed;
- the installations required (sidings, marshalling yards, depots) for the different categories of trains.

The *Spanish Railways* divide up the maintenance and renewal costs for the permanent way according to the number of pairs of wheels, taking into account the Driessen coefficients according to the speed.

The *Netherlands Railways* do not divide up these costs, with the exception of those for the lines on which only passenger or only goods services are run.

— *Maintenance and renewal of buildings.*

On the *S. N. C. B.* these costs, as well as those of maintaining the bridges, are divided up proportionately to the value of the installations, allocated according to their user or destination to the trains of the different categories of traffic.

When buildings and bridges are used for both passenger and goods services, the costs are divided up according to the coefficients given by the technical Department concerned (for example proportionately to the mileage in the case of bridges).

On the *S. N. C. F.* the method used is similar to that described above for the maintenance of the permanent way.

The *Spanish Railways* divide up the costs of maintaining and renewing buildings proportionately to the traffic for each category of trains (passenger and goods).

The *Netherlands Railways* do not divide up these costs.

— *Social service costs :*

The social costs on the *S. N. C. B.* and *S. N. C. F.* are divided up proportionately to the staff costs included in the cost of each category of trains.

The *Spanish Railways* divide up the social costs proportionately to the number of employees for each service (passengers and goods).

The *Netherlands Railways* divide up the social charges into two categories : the first includes the charges which are part of the wages, and the second the fixed charges per employee.

Finally the *Portuguese State Railways (Mozambique Colony)* include the social costs in their general management costs.

— *Financial charges.*

The financial charges of the *S. N. C. B.* only relate to the capital costs since the creation of the Company in 1926.

They are divided up in proportion to the expenditure allocated between the different departments in the case of new capital expenditure (track, signalling, buildings,

electrification, motor stock...) and then allocated amongst the different categories of trains in the same way as the operating costs, to which they are added.

The financial charges of the *S. N. C. F.* include :

- on the one hand the cost of fixed installations;
- on the other hand the cost of traction and rolling stock.

These charges are first of all divided up proportionately to the total costs under the various headings of the Capital Account.

The costs of the fixed installations are then allocated amongst the different categories of trains, in proportion to the cost of maintaining the permanent way, the cost of electrification being allocated entirely to the electric trains.

The cost of stock is divided up according to the inventory value of the stock used for each category of trains.

The *Spanish Railways* divide up the financial charges in proportion to the costs of each service (passenger and goods).

The *Portuguese State Railways (Mozambique Colony)* include the financial charges in the general management costs.

The *Netherlands Railways* consider that it is impossible to allocate their financial charges.

4. Expenditure per category of trains.

The above measures lead to the determination of the expenditure per category of trains.

Before dividing up the expenditure per category of traffic, the *S. N. C. B.* and the *S. N. C. F.* consider it necessary to make certain corrections to the results obtained in particular to take into account :

- service runs;
- light running;

These two factors are far from negligible. On the *S. N. C. F.* service runs represent about 6 % of the total traffic and light running about 30 % of the total mileage

— *Service transport.*

On the *S. N. C. B.* the cost of service trains is calculated separately for the passenger and goods services, according to the allocation of the costs amongst the different categories of trains.

This is done by ascertaining the expenditure of each department according to the bases upon which the costs are divided up amongst the categories of trains, taking into account the fact that certain items (tickets...) do not apply in the case of service trains.

The same method is applied in the case of service wagons included in the commercial trains.

The expenditure relating to service transport determined in this way is then divided up amongst the different debit headings, then allocated to the different categories of trains in the same way as the main costs.

For example, the cost of carrying coal is divided up in the same way as the fuel costs; the cost of carrying rails like the cost of maintaining and renewing the permanent way, and so on.

In short, the cost of service transport is added as items of expenditure to the principal costs.

On the *S. N. C. F.* the cost of service transport is evaluated separately, and then divided up amongst the categories of trains :

- in proportion to the cost of fuel, in the case of transport of coal;
- in proportion to the cost of materials for the other service transport costs.

— *Light running.*

The statistics of the *S. N. C. B.* show the light mileage to be debited to each category of trains and this is taken into account in the allocation of the costs.

Light running is negligible in the case of passenger rolling stock. The cost of wagon light mileage is added as a whole to the cost of goods trains which are not subdivided at the present time.

On the *S. N. C. F.* the cost of light

running is estimated separately and added to the different categories of trains in proportion to the mileage for each category.

Finally it should be noted that on the *S. N. C. F.* the cost of shunting is estimated separately and divided up amongst the different categories of trains, in proportion to factors determined by investigation.

The *Netherlands* and *Spanish Railways* do not make any corrections to take into account the cost of service transport and light running.

The *Portuguese State Railways (Mozambique Colony)* include these costs in the general costs for each system.

5. Costs per category of traffic.

The *S. N. C. B.* and the *S. N. C. F.* determine the costs per category of traffic (passenger-goods) from the costs per category of trains.

On the *S. N. C. B.* the costs are determined for the following categories :

- passenger traffic, divided up according to the method of traction;
- steam trains;
- Diesel rail motor coaches;
- electric rail motor coaches;
- luggage;
- parcels and mail;
- full loads;
- supplementary costs (haulage, disinfection...).

The passenger train costs are divided up among the passenger luggage and parcels traffic, attributing to these goods 40 % of the traction costs and cost of maintaining and renewing the vans, and 80 % of the train staff costs.

The costs of goods trains are divided up between small consignments and full loads according to the items and the T.K.B.R., W/km.

Station costs are divided up directly amongst the different classes of traffic.

On the *S. N. C. F.* the costs per class of traffic are obtained by the allocation of the

costs for the corresponding categories of trains, attributing however to the goods traffic part of the passenger train costs to take into account the goods transported by the mixed trains and the transport of express parcels by passenger train.

The costs are divided up amongst the following classes of traffic :

- main line passengers;
- suburban passengers;
- speeded up regime goods (R. A.);
- ordinary regime goods (R. O.).

all the cost of express goods being included with the R. A. costs at this stage.

The goods traffic costs are then broken down according to the traffic :

- in the case of « R. A. » :
 - express parcels;
 - small parcels;
 - full loads;
- in the case of « R. O. » :
 - full loads;
 - complete trains.

6. Financial balance sheets.

The costs of each class of traffic being determined, there is no longer any difficulty in preparing the financial balance sheet for the passenger and goods services, the receipts for each class of traffic being obtained directly from the accounts.

Although certain Administrations, in particular the *S. N. C. B.* prepare such financial balance sheets regularly every year by making a complete study of the costs, others on the contrary, such as the *S. N. C. F.*, only make such studies periodically, and are content to readjust their balance sheets each year in order to take into account modifications :

- in the economic conditions;
- in the traffic characteristics;
- in the mileage of various categories of trains.

The *S. N. C. F.* readjusts its financial balance sheets when preparing its budgets

(initial budget and three yearly reviews) and after the accounts for the year have been closed, in the following way :

for the basic year during which a general study of the costs was made, the kilometric cost P of each category of trains is divided up into 2 factors : one a representing the costs independently of the tonnage, and the other bt representing costs varying with the tonnage t of the train ($P = a + bt$).

As the average mileage and tonnage of the trains are known from a previous year, it is possible to determine, by the use of these formulae, the expenditure of this year, taking the real traffic into account and the economic conditions of the basic year, and ascertaining therefrom the costs per class of traffic.

The real costs are then obtained by multiplying the estimated costs by a coefficient of correction equal to the ratio between the estimated costs and the real costs of the year in question.

This method makes it possible to make frequent readjustments to the financial balance sheet with very close approximation to fact, without a great deal of work. It is sufficiently precise as long as variations in economic conditions and the traffic characteristics are not too pronounced.

On the other hand the *S. N. C. F.* has recently carried out an investigation to estimate the number of passenger-kilometers for the fast and express trains on the one hand, and the through and stopping trains on the other, which makes it possible to determine the amount of the receipts and then prepare financial balance sheets for the fast and stopping passenger services.

In general, the Railway Administrations only systematically prepare financial balance sheets per class of traffic for the system as a whole.

The preparation of balance sheets for a line or group of lines would require a great many statistics and a large clerical staff in the costing department; consequently large Railways only carry out such studies exceptionally, when necessary.

The *Netherlands Railways* for example

have prepared financial balance sheets per line, but almost only for secondary lines for which the expenditure can be ascertained directly, without making use of any arbitrary formulae.

Administrations operating both standard and narrow gauge lines generally divide up the expenses and receipts between the two systems.

Various Administrations, finally, subdivide their balance sheets per class of traffic :

- for the passenger balance sheet, into :
 - main line passengers;
 - suburban passengers;
- in the case of the goods balance sheet, into :
 - luggage;
 - small consignments;
 - full loads;
 - complete trains.

The *S. N. C. B.* also divide up the passenger expenses and receipts :

- per class;
- in each class, per category of passenger :
 - full fare;
 - cheap fares;
 - season tickets.

.....

Certain Administrations will not publish their financial balance sheets which they consider are strictly confidential.

The two following tables show the passenger and goods traffic characteristics for the *S. N. C. B.* and *S. N. C. F.* :

- units-km;
- train-km;
- T. K. B. R.

and the financial balance sheets for each class of traffic, in Belgian and French francs respectively :

Balance sheet for the passenger and goods service (*S. N. C. B.*) — (Year 1948).

Traffic characteristics :

	Passenger traffic	Goods traffic	Traffic as a whole
Kilometric units (in thousand millions) :			
— Passenger-km	7.1	—	7.1
— T. K. U.	—	6.2	6.2
Train-km (in millions)	50.1	22.1	72.2
T. K. B. R. (in thousand millions)	10.3	15.8	26.1

Financial balance sheets (in thousand millions Belgian francs)

	Passenger traffic	Goods traffic	Traffic as a whole
Total expenditure	4.5	6.2	10.7
Receipts	2.6	5.5	8.1
Results	— 0.7	— 0.7	— 1.6

Length of lines in operation (at 31st December 1948) : 5 025 km.

Balance sheet for the passenger and goods services (S. N. C. F.) — (Year 1948.)

Traffic characteristics :

	Passenger traffic			Goods traffic	Traffic as a whole
	Suburban	Main line	Total		
Kilometric units (in thousand millions) :					
— Passenger-km	4.7	25.9	30.6	—	30.6
— T. K. U.	—	—	—	45.4	45.4
Train-km (in millions).	18.4	137.7	156.1	199.8	355.9
T.K.B.R. (in thousand millions) . . .	5.2	40.3	45.5	125.3	170.8

Financial balance sheet (in billions of French francs.)

	Passenger traffic			Goods traffic	Traffic as a whole
	Suburban	Main line	Total		
Total expenditure.	11.5	87	98.5	190.0	288.5
Receipts	4.4	61.0	65.4	189.4	254.8
Results.	— 7.1	—26.0	—33.1	—0.6	—33.7

Length of lines in operation (at 31st December 1948) : 41 300 km.

The results of these financial balance sheets are very similar, as the table hereafter shows, giving all the data in percentages.

7. Utilization of the financial balance sheets.

In the first place these balance sheets are used to ascertain the results (profit or loss) of each category or sub-category of traffic. Consequently they are one of the factors from which the rating policy can be determined, though naturally other considerations, especially commercial ones, must also be taken into account.

For example the analysis made by the *S. N. C. B.* of the costs of the passenger services per class and per kind of tariff

enables them to compare the profits from each class of carriage and determine to what extent such and such a rate would improve the general balance sheet or on the other hand involve a loss for the Railway.

A knowledge of the marginal costs makes it possible to determine the minimum rates (bottom scale) below which the rates should not normally be allowed to fall.

The information deduced from these balance sheets also makes it possible to fix the minimum rates for certain traffics (workmen, popular holidays...).

These calculations are also used to determine the sums to be claimed to pay for certain services which must be fixed in relation to the cost (for example the postal transport in France).

Comparison of the balance sheets of the passenger and goods services of the S. N. C. B. and S. N. C. F.
(Year 1948.)

	S. N. C. B.		S. N. C. F.	
	Passenger traffic	Goods traffic	Passenger traffic	Goods traffic
<i>Traffic characteristics :</i>				
— Units-km	53 %	47 %	40 %	60 %
— Train-km	69 %	31 %	44 %	56 %
— T. K. B. R.	39 %	61 %	27 %	73 %
<i>Financial results :</i>				
— Expenditure	42 %	58 %	34 %	66 %
— Receipts	32 %	68 %	26 %	74 %

These costs are finally used :

- to determine the most economic routing of the traffic;
- for co-ordination studies;
- for preparing balance sheets when it is proposed to substitute Diesel or electric traction for steam traction.

In general, the different Railway Administrations do not make use of this information to keep a check on their expenditure, since their accountancy services supply

them with more detailed information for this purpose.

This brief review of some of the uses of financial balance sheets for the passenger and goods services brings into light their considerable value. As long as they are prepared with sufficient accuracy, they are an extremely valuable means of analysis for the very complicated operations of Railway Administration.

INTERNATIONAL RAILWAY CONGRESS ASSOCIATION

15th. SESSION (ROME, 1950).

QUESTION VII.

Organizing methods to be used in large marshalling yards and terminals, to reduce to the minimum the cost per wagon shunted.

Determination of the staff and number of shunting engines needed;

Capacity and control of the efficiency of the marshalling yards;

Recording and numbertaking arrangements in the arrival and departure yards;

Statistics and traffic analysis by the control-room;

Braking and retarding arrangements;

The formation of trains for departure.

REPORT

(Austria, Bulgaria, Czechoslovakia, Finland, Greece, Hungary, Italy, Portugal and Colonies, Rumania, Spain, Sweden, Turkey and Yugoslavia.)

by Eng. M. CIRILLO,

Inspecteur en chef Supérieur au Service du Mouvement des Chemins de fer italiens de l'État.

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INTRODUCTION.

While the seeking out of the most rational and economical methods for organising the work of marshalling yards has ever been one of the most important aims of Railway Administrations, it has today become an absolute necessity, as reduction of the cost per wagon shunted to the minimum can have a remarkable effect upon the operating costs and can ultimately lead to a reduction in the costs in the face of competition from other methods of transport.

The large marshalling yards, particularly those equipped with up-to-date and improved installations, are extensive working areas where the co-operation of several services simultaneously necessitates the employment of a very considerable staff and number of shunting engines. Consequently intelligent organisation is essential, in order to obtain the maximum profit from the existing installations and resources, especially in the case of those yards where a reduction in the traffic results in their having to deal with fewer wagons than their normal capacity.

The questionnaire sent to the Administrations was intended to ascertain and compare the methods of organisation applied in the different countries, in order to decide which systems were preferable from the economic point of view.

CHAPTER I.

General measures to improve the output of marshalling yards.

1. *Train timings. — Notification of composition — Labels and inscriptions.*

One of the first measures is to organize the service outside the yard, especially with regard to establishing and balancing of the train arrival hours and preliminary notification of their composition.

If it were possible to prepare time tables for trains arriving at a marshalling yard in a uniform manner, according to a given frequency, the shunting and making up of trains might also be carried out uniformly

throughout the day, thus enabling better use to be made of staff and shunting engines available, with a consequent higher output.

In practice, it is difficult to arrive at a proper equilibrium in train arrival times (and consequently in train departure times), in view of the different circumstances which may arise, either from the point of view of the train running or from traffic characteristics. It is necessary, however, to time the trains in such a way that the wagons will be sent forward as quickly as possible and that there will be a sufficient concentration of stock during the different periods of the day in order to ensure that the available resources are utilized to their full extent.

In this connection, the Italian State Railways, whilst endeavouring to time their through goods trains as regularly as possible throughout the day, are not able to do so in the case of the stopping trains. These trains, serving the intermediate stations, generally run during daytime and reach the marshalling yard or terminal station (end of the line) in the early evening. In this way stock arriving at a terminal station is marshalled during the night in order to make up the through trains, which leave early the following morning. Other circumstances, such as the running of extra trains, connections at transit stations, the necessity for carrying certain traffic at given hours, etc., also make it necessary to interrupt the established frequency.

In practice, it often occurs in Italian yards that there is a very heavy concentration of stock to be marshalled during the night, which is both an advantage and a drawback.

The disadvantage resides in the slowing down of the work of marshalling during certain hours of the day while the advantage is greater facility and rapidity in making up trains when a large amount of stock is available.

The Swedish State Railways are of the opinion that train arrival and departure times should be adapted as far as possible to the capacity of the marshalling yard, so that work may proceed as easily as possible. However, as the marshalling yard is only

a tool for handling traffic, it must be adapted first and foremost to the exigencies of that traffic.

The Austrian Railways, when any change is made in train timings, select the most suitable hours for arrival and departure at each yard, according to a stock exchange programme which takes into account the work and output characteristics of each yard, as well as those of the adjacent yards and lines.

The Spanish Railways stagger the arrival of trains in the marshalling yards in order to obtain normal marshalling, making up and departure of the corresponding trains. However, as most of the lines on the system are single track and passenger trains have priority, in practice the times of the goods trains cannot always be respected.

Generally, all the Administrations are of the opinion that train times should be so arranged that the time spent by wagons in the yards is as short as possible, taking into account the capacity of each yard. On the other hand it is also important to ensure regular running of trains, so that the times are adhered to.

The system of notifying the composition of the trains before they arrive at the marshalling yard is enforced by several Administrations, who consider it useful to let the yard know beforehand certain details such as total number of pairs of wheels; number and weight of certain express wagons or special wagons; number of pairs of wheels and weight of wagons for transit via certain yards, etc., in order that the necessary steps may be taken in good time. This preliminary notification — which can be given directly by certain stations or by the dispatching — enables the marshalling yard to take the necessary steps before the arrival of the trains, or — if need be — to decide on the making up or cancellation of regular trains or on the running of extra trains, the way the wagons will be sent on, or how certain traffic will be dealt with extra rapidly, etc.

The Italian Railways have not laid down any general directives in this matter, but leave it to the yards to act as circumstances dictate. Consequently in the case of certain

yards, advance notification is limited to the make up of trains carrying foodstuffs and trains with several express wagons which must be sent on immediately, or merely to trains of empty wagons; other yards, however, are notified of the composition of all trains as well as the destination of the wagons.

On the Australian Railways notification of the composition of trains must be given by telegram or telephone to the stations at the end of the line and the marshalling yards before or immediately after departure of the train.

The advance information intended to enable the necessary means of traction, for reinforcing regular trains, to be made available in good time is known as «load advice» and contains, in particular, the following details :

- strength and depot of the train staff;
- number of pairs of wheels, braking weight and system of braking of each lot of wagons, according to destination;
- number and destination of wagons which are late;
- braking weight — by air — or hand brake — required for the following run (to another yard or to end of the line).

The Hungarian Railways have introduced, as an experiment, a system of notifying the composition and gross weight of trains to which no change is to be made in the dividing up section.

On the Czechoslovakian Railways, preliminary notification of the composition of the trains (train analysis) is also given; such notification is made by telephone or telegram.

The Spanish Railways do not give any preliminary notification of the composition of each train; however, as the marshalling yards are already aware of the destinations of the rakes they are to receive, the R. E. N. F. E. have been able to evolve a system of allocating wagons based on the train indication services.

To make it easier for employees in the yard to know the siding to which trains are to be shunted and to assist in the making

up of the trains, most Administrations make use of special labels, fastened to the wagons.

In Austria, labels are attached at the departure station, according to the special regulations governing the itineraries; these labels show a number corresponding to the marshalling yard concerned (i. e. the last yard through which the wagon will run before reaching its destination station).

The Hungarian Railways adopted a similar method, characterized by the fact that different coloured labels are used, according to the group of lines concerned, giving both the name of the station and the route.

On the Italian State Railways the labels are fastened to the wagons after the train's arrival, and include the following data :

- date and train number;
- wagon number and gross weight;
- destination station and last transit concerned;
- kind of traffic (express, grouped, etc.) and if need be characteristics of the goods (fragile, dangerous, etc.);
- shunting siding which has been earmarked.

Where necessary, other details can be added to facilitate the work.

In yards where the marshalling installations are not automatic, vehicles — in addition to the above labels — are also identified by inscriptions chalked on the front of the first wagon of each cut, showing the shunting siding and sometimes the nature or characteristics of the goods (for example : oil, fragile).

The Czechoslovakian Railways give the destination station and route on the labels. Detailed instructions regarding the marshalling sidings are given to the staff by means of the shunting labels, by radio or by chalked up inscriptions on the wagons.

The Spanish regulations do not provide for any special indications on wagon labels to show the sidings to which they are to be shunted. However, it is laid down that labels with a three figure number must be used on the wagons, the first figure showing

the zone or region of the destination of the wagon, and the next two the Division or section in which the destination station is situated. This enables the staff to know at sight the marshalling and making up sidings concerned.

Certain other Administrations, such as the Swedish State Railways, do not make use of this method.

2. Co-ordination of the different operations: Use made of the marshalling sidings.

In order to enable the work of the yard to proceed along rational lines, and to co-ordinate the different operations and speed them up as far as possible, there is generally organization or a working plan covering all these operations, according to a predetermined sequence and which makes provision for the simultaneous carrying out of certain services without their interfering with each other.

Thus when the train arrives in the reception group of sidings, identification and technical inspection of the stock are carried out simultaneously, after which the cut-label is made out, and the clerical work, uncoupling of cuts, shunting, etc., is done. The plan also covers the shunting required for making up the trains, clerical work on departure, etc. The work of the different parts of the yard is carried out under the orders and supervision of a responsible employee (yard manager or foreman) assisted by qualified technical staff, assigned to the different parts of the yard.

One of the most important measures covered by the plan is the allocation of the marshalling sidings, which in principle provides a siding for each direction, taking into account the composition and nature of the trains. However a same siding may be used for more than one purpose, according to the particular requirements of the yard or the traffic, in a given direction or for a given period of the day, or for other reasons.

It may also be necessary to modify at times the purpose for which a siding is used, according to circumstances and particular cases not provided for beforehand.

In the case of the Italian State Railways, the allocation of the sidings is usually permanent: part being reserved to one same kind of stock for making up the through trains — long distance — and part being used as necessary for the wagons for semi-direct or stopping trains (the latter are re-shunted afterwards in the making up group of sidings).

The allocation of sidings for wagons of one same kind is limited in any case by the number of sidings available in the yard; on the other hand, the reservation of a siding for a given direction must take into account the length of that siding as compared with the amount of traffic for that direction, as well as its position and distance from the departure group of sidings. In order to enable wagons to be cleared for several trains leaving in different directions at the same time, of for certain categories of stock (such as : wagons loaded with small consignments, etc.) the marshalling sidings in certain yards can be grouped into several sectors and allocated accordingly. For example the 32 marshalling sidings in Bologna S. Donato yard have been grouped into 3 sectors, the first of which (10 sidings) is allocated to wagons for the South; the second, in the centre of the group (9 sidings) is used for wagons for various destinations, wagons loaded with parcels traffic and empty wagons; and the third (13 sidings) is reserved for wagons for trains to the North.

The Hungarian Railways allocate sidings for directions where there is always a great many wagons, whilst one or several common sidings are allocated for the less important traffic currents.

Similar plans are followed by the other Administrations, in particular the Czechoslovakian Railways. The latter do not previously allocate the sidings in certain small yards, owing to the lack of sufficient installations; the sidings are then used according to need.

The Spanish Railways determine the use to be made of each siding, and draw up a plan which must be rigorously adhered to, apart from special circumstances.

3. *Output bonuses.*

Among the methods which are likely to improve the use made of the staff, shunting engines and stock, and which consequently improve the output of marshalling yards, is the introduction of output bonuses for the staff. Practically none of the Administrations with which we are concerned has adopted this method as yet, but most of them are in favour of such bonuses.

The Austrian Rys. and Italian State Railways already pay bonuses to their staff. In the case of Austria, the bonus (one schilling) is paid to all the staff engaged on shunting, but is merely paid as an indemnity against risk. In Italy so far the bonus has been paid to all the staff used for making up the trains.

The Italian and Czechoslovakian Railways have recently completed a study of two complete and rational output bonus systems intended to encourage the staff to devote the whole of their diligence and interest to carrying out their work. These systems are shortly to be introduced.

The Spanish Railways, where a system of bonuses is already in use with regard to regularity of the train services and turn round of the stock, have not yet introduced bonuses for the marshalling yard staff, but this question is under consideration.

4. *Average idle period and number of wagons shunted per shunting engine hour.*

The output of a marshalling yard is governed by certain factors, such as the time which elapses between two consecutive rakes passing over the hump, the average time wagons remain in the yard, the number of wagons shunted per shunting engine hour. Leaving on one side for the moment the interval of time determined by the shunting frequency — which we will deal with later on — it is interesting to ascertain and compare the information concerning the average time wagons remain in a yard, at normal traffic times, in several marshalling yards. Data received in this connection was not sufficient either in quantity or in kind to enable any useful conclusions

to be drawn, particularly as the yards concerned are not all equipped in the same way.

The Austrian Railways report, in the case of one of their best equipped yards with very heavy traffic, an average idle period of 3 hours 10 minutes, and give the following factors as a basis for this calculation :

— identification and clerical work on arrival	50 minutes
— shunting	15 »
— making up of the trains in geographical order	40 »
— preparation of trains for departure	50 »
— testing brakes and handing over to train staff	35 »

In other yards on the same railway, the average time wagons remain in the yard varies from 4 to 14 hours, according to the importance of the traffic; the time may be as much as 20 hours when there is only one service a day for certain directions.

The time wagons remain in the Swedish yards is from 4 hours 20 minutes to 5 hours, as disclosed by a special investigation carried out in the 6 existing marshalling yards during a week of normal traffic. The calculation of the average idle period, which does not include the time wagons remain in the transshipment sidings, was carried out by means of special tables showing the number of wagons coming in from hour to hour, together with the wagons sent out, and the time difference between the two.

The Italian Railways which have three up-to-date yards and others less extensively equipped, report that the wagons remain 11 hours 30 minutes on the average in the former, and about 20 hours in the latter.

The method used for the calculations is the establishment of the arithmetical mean (over a certain period, for example 3 days) of the actual time all the wagons coming in remain in the yard, the movement of which is followed through the various parts of the yard until they leave.

The Hungarian and Czechoslovakian

Railways did not give any statistical data on the average time. The former have estimated the standard times (unit time) for all yards, dealing separately with wagons arriving, wagons sent out, and wagons in transit; these standards are based on local reports and the traffic on the lines.

In Czechoslovakia different statistics are used depending upon the extent to which it is possible to co-ordinate appropriately the arrival and departure of trains from the yard in a given direction.

The Spanish Railways, whilst stating that they only calculate the average idle period in the case of the most important yards in order to use this as a basis for the payment of a premium in given key yards, give no details of the method used.

The Turkish and Swedish Railways have no up-to-date marshalling yards; in addition the former does not make any investigation into the factors in question, and merely appoints a central organisation to follow both the evolution of traffic and the time spent en route and in the « local » yards.

An examination of the data supplied by the different countries and applying to various types of yards, shows clearly that many factors are not comparable, though their influence upon the results obtained is considerable. We are of the opinion that this depends, in the first place, on the fact the traffic characteristics are not the same everywhere, nor all the time. Thus if there are insufficient wagons for a given direction (especially at the present time when the falling off in traffic has affected different directions in different ways) the yard is obliged to retain wagons for this given direction longer, thereby increasing the average time wagons spend in the yard, as compared with other yards where conditions are different.

It is also necessary to take into account differences of equipment : the speed at which shunting can be carried out depends on the favourable or otherwise siting of the reception and making up groups or departure sidings, and consequently its affect upon

the time wagons remain in the yard will differ from one yard to another. Finally other factors also come into play, such as the geographical position of the yard, local operating conditions, etc.

In any case, the very considerable difference in the time wagons remain in some Administrations yards, and in the Italian yards, cannot be due solely to the above reasons. We rather presume that some Railways have differed from others in their method of taking into account such factors as : the period between one shunt and the next, interruptions to the shunting, closing up of wagons in the sorting sidings, the removal of damaged or registered wagons, awaiting the time of departure (it is not always possible to arrange the timetables in such a way that trains can leave immediately they are ready) delays (1) due to the yard or exterior reasons. On the other hand, there is considerable difficulty in isolating effectively the marshalling yards when calculating the idle periods.

As regards the number of wagons shunted per shunting engine hour, the calculation generally includes wagons only sent out or wagons arriving (Austria, Hungary). The results, however, are not uniform, because of the different principles followed in such calculations, as well as the different conditions as regards installations and operation in the yards concerned. (In fact, the output of the engines is closely linked up with the length of the runs, the length and weight of the rakes, their specialised use, etc.).

For example Czechoslovakia reports an average of 100 wagons per shunting engine hour, whereas in Austria the output of an up-to-date yard is given as 67 wagons an hour. (These figures correspond to the effective shunting hours worked during the day : i. e. 37 hours for a total of 2 500 wagons dealt with).

In Sweden, the number of wagons shun-

(1) The Austrian Railways do not include train delays.

ted, counting the wagons once only (on leaving) is, on average, 30 (1 200 — 1 500 wagons dealt with, 40/50 shunting engine hours). As certain yards are run in conjunction with a transshipment depot whilst others are not, the Swedish Railways — to make comparison easier — count wagons sent from the depot to the yard as wagons leaving. Parcels traffic wagons transhipped at the yard are always counted twice : there are about 150 such wagons daily in the large yards, i. e. 10 % of the total number of wagons dealt with.

In the Spanish yards the number of wagons per shunting engine hour is 40.

In the best equipped Italian yards, the number in question varies between 45 and 55 in the case of the sorting sidings and 22 to 25 wagons in the case of the making up yards; the general average obtained from the yards as a whole (apart from the local and transshipment depots) is about 13 wagons.

Only a few Administrations gave the average number of wagons dealt with daily compared with the total number of employees in the various departments.

However, as the figures given refer to differing conditions as regards work, installations, and perhaps method of calculation, from one country to another, no useful comparison is possible.

For example an output of 117 wagons per pointsman and 36 wagons per shunter reported by Austria, corresponds to an output of 64 and 26 wagons respectively for Italy and Sweden. In the case of Italy, it should be noted that the above figures correspond to the present situation, where with a falling off in the traffic, it has not always been possible to reduce proportionately the number of men in the different parts of the yard, especially the pointsmen. In particular the existence of central electrified posts, built to deal with heavy traffic, has obliged the State Railways to keep them all in repair although the number of wagons to be dealt with has fallen off considerably.

CHAPTER II.

Control and general supervision of work.

5. *Station control post. — Regulator.*

The planning of work for a marshalling yard requires in every case a management in charge of operations which can also control and supervise the work. On certain Railways, such as the Austrian, Spanish, Hungarian, Swedish and Turkish, the yard master, assisted by one or two assistant managers, is responsible for the control and general supervision of work. They are responsible principally for the shunting, the co-ordination of work in the different parts of the yard, the reception and making up of the trains, etc. In the up-to-date Italian yards, there is a central control post known as the « traffic regulators post » responsible for the co-ordination and supervision of all the operations taking place in the yard from the arrival to the departure of a train.

The *regulator* (who is an assistant yard manager directly under the yard master) can communicate, by means of a selector telephone installation, with all the main parts of the yard : shunting posts, automatic switch box, brake box, hump, marshalling and making up groups of sidings, transshipment depot, locomotive shed, train staff depot, etc.

Thus the *regulator* is fully cognizant, at all times, of the actual position as regards the trains and shunting, and, by following the work of the yard through all its phases, he is able to intervene in order to co-ordinate the operations with a view to making the best possible use of the staff and shunting engines available. The corresponding posts supply him with all necessary data, so that he is always informed of the situation in the different parts of the yard as a whole. The *regulator* keeps a graphical record of the train movements and shunting showing — from arrival to departure of the trains — all movements of the stock from one part of the yard to another, and the time taken. In particular he concentrates on the regularity of the shunting, the clearing of material

after shunting, and its prompt transfer to the making up group of sidings, and then to the departure sidings.

The *regulator* is also responsible for seeing that on the arrival of trains, the locomotives are sent as soon as possible to the sheds and that the sheds dispatch locomotives in good time for the trains leaving. Finally he is in touch with the « dispatching » service regulating the circulation of the trains on the different lines leading to the yard, keeping them informed as to the composition of the trains and their destination marshalling yards.

In Czechoslovakian yards, an official is responsible for controlling the whole of the yard and directs operations. Traffic control has been introduced in order to co-ordinate the working of several marshalling yards.

6. *Adjusting of staff and shunting engines to variations in traffic; running of extra trains.*

In order to adjust, as far as possible, the use of available resources to the actual work of a marshalling yard, it is necessary first of all to have a complete knowledge of fluctuations in the traffic and, secondly, a system of organisation which is sufficiently flexible to meet varying circumstances.

Generally, the work programmes are prepared in advance taking into account the variations in traffic which can be considered constant, i. e. seasonal weekly, and also daily variations. Using these factors as a basis for calculation, the number of men and engines required for the normal services is then established. Daily variations in traffic are closely checked, first of all by the yard-master (or by the dispatching dept.), who keeps a record of the number of wagons dealt with, the utilisation of trains, and the number of wagons remaining after they have left.

In general, however, it is the regional and central operating department offices which check and estimate fluctuations in the traffic, from the statistics concerning stock arriving or sent out in the different directions. By means of these factors the resources of the yard and the train times can be adapted to meet different situations.

As far as possible, also, unforeseeable traffic arising from special circumstances such as, for example, the unexpected arrival of several more ships than usual at the ports near marshalling yards, are also taken into account.

Abnormal variations in traffic are gauged particularly from the record of the number of wagons dealt with daily, the utilisation of the trains, and the number of wagons remaining in the yard after their departure.

The normal requirements of a marshalling yard are generally met by providing a number of regular trains sufficient to clear the average daily traffic on which the work programme is based. However, when it becomes necessary to clear a certain number of wagons remaining in the yard after the regular trains have left, extra trains have to be run.

Naturally the running of such trains must be subject to very careful examination, not only from the point of view of clearing the yard, but also as regards the rapid transport of the traffic and proper utilisation of the train staff and engines. If the yard is equipped with a control post, such as the « regulator » on the Italian State Railways, or the « dispatching » on the Czechoslovakian Railways, this post will be responsible for running any extra trains, according to the circumstances, and if need be in agreement with a higher authority. In other cases the yard master (or assistant manager) puts in a request for the trains needed to the regional distribution office or central district post concerned, giving the details of the number of wagons remaining or notified, their tonnage, etc.

In certain cases the yard may be given permanent authority to run certain extra trains whenever necessary.

As the traffic is more or less constant, the extra trains are usually the same ones for given destinations. However, it may occur, due to considerable fluctuations in traffic (such as an exceptional number of loaded or empty wagons) or at certain periods of reduced traffic, that all the train services (both regular and extra) have to be modified according to circumstances. In

such cases, it will be necessary to run extra trains to destinations other than normal, suppressing (if need be) some of the regular trains.

On the Italian State Railways the running of extra trains is subordinated to the complete utilisation (100 %) of the power of the locomotives used, and can only take place when the regular trains have been run as follows :

- 90 % (at least) of the power of the locomotive for through or semi-through ordinary goods trains;
- 70 % (at least) of the power of the locomotive in the case of stopping trains. Exceptions to these limits can be allowed exceptionally in the case of trains loaded with foodstuffs, or empty wagons.

The Hungarian Railways run additional trains if the regular trains are insufficient for the number of wagons to be transported.

7. Control of work and of the general output of the yard.

The output of a marshalling yard is strictly bound up with the proper utilisation of the equipment and staff available, which implies not only a constant check on the work in the different parts of the yard, but also the mathematical tabulation and comparison of the various factors of the work involved.

Consequently, apart from the control on site exercised by the control post or yard manager with regard to the number of wagons shunted, the time wagons remain in the yard, the number of wagons at one or several given times, delays in the shunting, making up and utilisation of trains, etc., these factors are also checked at a higher level, generally by means of daily or monthly statistics.

In particular, in Austria, the employee in charge of shunting, records the actual shunting times and stopping times; as the engines are fitted with tachometers, it is possible to check their effective work. The general output of the yard is shown on a suitable graph.

On the different Railways, the statistics in question may refer : to the total number of wagons arriving in the yard during the 24 hour period, to the average total time wagons remain in the yard and to the average idle period for the different directions (in absolute figures and in percentage), to the shunting engine hours, the total number of trains dealt with (either altogether or in each direction), as well as to their utilisation, to the number of employees working in the yard (as a whole and per category), as compared with the wagons dealt with, average delays to trains on arrival and at departure, etc. A study of these factors makes it possible to determine the general output of the yard and the average cost per wagon dealt with, as well as making it possible to adjust the use of staff and shunting engines to the actual work.

CHAPTER III.

Checking, numbertaking, etc. (Marking off.)

The organization of a marshalling yard generally includes a marking off service, the object of which is to identify the wagons on trains arriving in the yard, and preparing — on the basis of their waybills — the labels or inscriptions for the wagons and the shunting lists, and with regard to trains leaving, to prepare the documents which go with them.

In the Italian marshalling yards, for example, there are special offices known as « stock offices » to which all the employees responsible for the above mentioned duties are attached and where all the clerical work in connection with the wagons is performed. In each yard there are one or two stock offices, according to the position of the reception and departure groups of sidings and the amount of work that has to be done; the work is performed by a certain number of employees subordinate to a head clerk. The staff employed in the single office (or in the arrival office), after identifying the wagons, by means of the papers supplied by the guard, enter them

up in a special register ⁽¹⁾ and prepare the ordinary labels and the cut label. When this has been done, markers off label the wagons and if needs be, also mark off the cuts.

The markers off for trains due to leave have to collect the details of the wagons to be cleared, which is the basis of the entries in the register of wagons leaving, identical to that of wagons arriving, and on the list of wagons accompanying the train (vehicle waybill) ⁽²⁾. When these operations have been completed, the documents are sent to the departure group of sidings when the wagons are checked, and finally are handed over to the train staff.

On the Swedish State Railways the number of markers off employed is about 6 a day. Each train is accompanied by a list of wagons, prepared by the markers off, giving in particular the following details :

- mark and number of wagons;
- destination station;
- number of pairs of wheels and weight of the wagons (given separately for the two classes : « open » and « covered » and if needs be « loaded » and « empty »).

The list of wagons is prepared in duplicate, one copy being kept by the departure yard and the other accompanying the train to the destination station, where it is used as the train list on arrival. The markers off are not concerned with the preparation of the cut labels which are made out by the foreman of the shunting gang.

On the Spanish Railways all wagons arriving or leaving are entered in a register kept for each direction. This book is

(1) The register gives the following details : date of arrival, origin, destination, mark, series, number of wagons loaded and empty, kind of goods, gross weight.

(2) The vehicle waybills show the following details : departure and destination stations, intermediate station which may add vehicles : mark, series, number of pairs of wheels, number of loaded and empty wagons; kind of goods, gross weight and braking weight, stamp of the yard withdrawing the wagons and signature of the employee concerned.

entered in duplicate and the copies are sent every twenty-four hours to the Section Inspector.

A special employee for each direction is responsible for collecting the way bills from arriving trains, entering them up, and if necessary labelling the wagons. The service is organized in the same way for trains leaving.

No cut labels are prepared. No special control is exercised over the work of the labellers; they receive the necessary instructions or special instructions from the assistant yard manager responsible for marshalling.

The work of the markers off is generally regulated by the work programmes. In the best equipped Italian yards, the « regulator » supervises the work of the markers off so as to keep a constant check on the movement of the traffic.

In Austria the wagons composing the train are not entered on arrival, as a copy of the labels on the wagons is attached to the train list and collected by the yard marking off office.

On departure, the train guard has to prepare a label in duplicate for each wagon; the original accompanies the train, attached to the train list, while the copy remains at the yard. In addition the wagons are entered on the cut labels prepared by the shunting staff.

In Hungary, all wagons arriving and leaving are entered. The marker off on arrival prepares, at the same time as the train list, the marshalling list and cut labels which are completed at the transit office.

The books kept are :

- a) the record of wagons arriving;
- b) the record of wagons leaving;
- c) the marshalling list or cut label.

The markers off receive their instructions from the yard manager.

In Czechoslovakia, the marker off receives the train documents from the conductor when the train arrives, compares them with the wagon lists and stamps them. On departure, the marker off arranges the train

documents according to the direction of the destinations of the different wagons and hands them over to the train staff. The markers off are likewise responsible for preparing the cut labels; their duties, which are governed by special directives, are independent.

Other Administrations, which do not possess any marshalling yards with up-to-date equipment (for example the Turkish Railways) have no real marking off services. The work of the markers off is regulated by the goods office foreman and, as regards the consigning of wagons, these employees work under the direct orders of the assistant manager of the department.

CHAPTER IV.

Examination and repair of wagons.

8. Technical examination of wagons withdrawn from the train.

The technical examination of wagons is generally effected after the arrival of the trains — in the reception sidings — as well as before their departure, in the making up or departure sidings.

Examination on arrival, which takes place at the same time as the identification of stock, is the most important, as the spotting of damaged wagons before they are shunted makes it possible to withdraw them as soon as they come into the yard and thereby

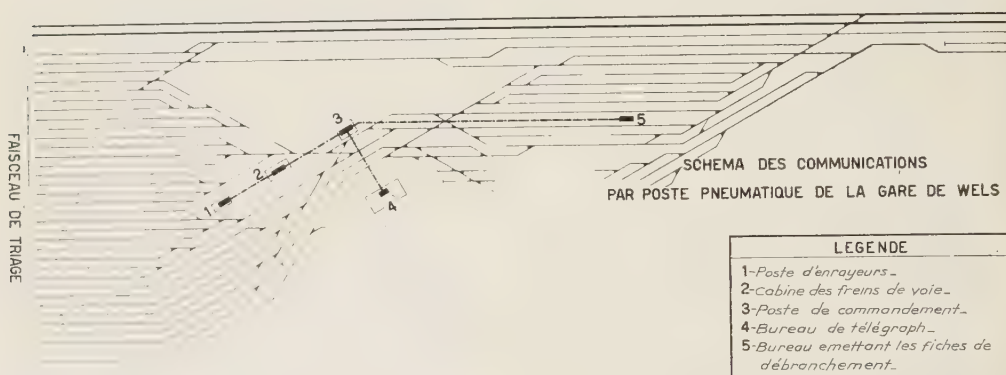


Diagram of pneumatic communication in the Wels yard.

Explanation of French terms: — 1. Poste d'enrayeurs = Brakemen's post. — 2. Cabine des freins de voie = Track brakes control box. — 3. Poste de commandement = Control post. — 4. Bureau de télégraphe = Telegraph office. — 5. Bureau émettant les fiches de débranchement = Office issuing shunting lists. — Faisceau de triage = Marshalling group of sidings.

The forwarding of the papers and commercial documents which travel with the wagons within the yard is usually done by porters or markers off, who travel if necessary on the locomotives in use or by other convenient means.

In the case of the Italian yards, only that at Bologna San Donato — which is the most up-to-date and still under construction — has been equipped with a pneumatic installation for the rapid transport particularly of the marshalling lists. A similar installation is already in service in the Austrian yard at Wels as shown on the attached diagram.

avoid shunting wagons which are already damaged.

Examination after shunting is intended to spot any damage occurring during marshalling, particularly on account of shocks when stopping, especially in yards where wagons are stopped or retarded by hand.

The Italian yards are generally equipped with fixed inspection posts in the reception and departure groups of sidings, and in the transshipment depots; where required, examination may also be effected in the marshalling group (one man at the entrance to and another at the exit from the group of sidings).

The examiners work according to an established programme, which includes examination of all the regular trains on arrival and departure; such staff are subordinate to a chief examiner.

As regards their work, the examiners receive their orders from the Regulator (where there is one) or from the yard assistant manager, who orders the examination of extra trains, and if necessary of wagons on any siding.

The Regulator who follows the work of the examinees, decides amongst other things, when damaged wagons are to be withdrawn from trains due to leave, so that the making up of the trains can be completed in good time and that no delay shall be occasioned by wagons having to be withdrawn after making up and when they are on the departure sidings.

As a matter of principle wagons are not withdrawn from the marshalling sidings; such withdrawal only occurs exceptionally, in the case of slight damage.

On the Swedish Railways in the case of wagons starting from the district served by the marshalling yard, technical examination is sometimes permitted at the consigning station before they leave for the marshalling yard; in this case, no inspection is then made on arrival at the yard.

The work of the examiners is controlled by programmes, and they are grouped into shifts under a foreman who himself takes part in the work; the examiners themselves are responsible for their work.

In Austria the technical examination takes place both on arrival and departure, and, in conformity with the special regulations in force, a special inspection is made of the brakes on trains for mountainous lines with heavy gradients.

The work of the examiners is controlled by a programme prepared, whenever the times are altered, by agreement between the yard management and the traction services. Changes which may occur owing to delay or cancellation of trains, the running of extra trains, etc., are regulated by agreement between the assistant manager

and the examiners concerned. In every case the examiners are under the orders of the traction control department.

The Turkish Railways enforce the usual method of inspection, by two groups of examiners, in the reception and departure sidings; inspection in the making up sidings only takes place when actually requested.

As regards the average proportion of wagons to be withdrawn on the different sidings, it would be interesting to ascertain and compare the figures for several yards, unfortunately we are in possession of only a few details in this connection supplied by the Italian and Austrian yards, and which are shown in the table on the next page.

The figures given, although not uniform, do show however that most of the damage is discovered on the reception sidings and wagons which have to be withdrawn on the marshalling sidings represent only a very small, almost negligible quantity.

The high percentage of wagons to be withdrawn on the Austrian Railways is due above all to the condition of the stock of wagons now owned by these Railways. On the other hand, the state of the installations — which have not yet been completely rebuilt since the war — also causes certain damage in the marshalling and making up groups of sidings.

The Hungarian Railways — whilst not giving any actual figures — state that the proportion of wagons withdrawn on the reception sidings is practically the same as on the making up sidings; on the other hand this proportion is considerably reduced in the case of the departure sidings.

The Czechoslovakian Railways also did not give any figures, but report that the proportion of wagons withdrawn on the various sidings varies according to the kind of installations at the yard and the nature of the consignments.

9. Repair of damaged wagons.

Generally, all marshalling yards have one or two sidings reserved for damaged wagons, which can be repaired on the actual

Proportion of wagons withdrawn.

STATIONS	On the reception sidings	On the marshalling sidings	On the making up sidings	On the departure sidings
<i>Italian yards :</i>				
Milan-Smist	5 0/00	0.8 0/00	0.1 0/00	0.8 0/0
Bologna S. D.	4 0/00	—	—	0.1 0/00
Rome Smist	8 0/00	1 0/00	—	0.8 0/00
<i>Austrian yards</i>	20 0/00	10 0/00	10 0/00	—

sidings or — in the case of serious damage — left there temporarily before being sent to the yard repair shop.

On the Swedish Railways one or two sidings are reserved for damaged wagons needing small repairs or whose loads have to be attended to.

Similarly, the Turkish Railways generally reserve a siding for small repairs in order not to hinder work and to leave free access to the other sidings.

The Spanish Railways reserve at least one siding in all their marshalling yards for small repairs (70 % of these repairs are effected on the marshalling-and making up sidings).

In the Italian yards, one or two marshalling sidings are also reserved for damaged wagons, but small repairs are not usually made on these sidings which, on principle, are merely used to hold the wagons until they are forwarded to the repair shop.

Generally, if two sidings are available, one is reserved for wagons needing minor repairs and the other for wagons with more serious damage; in any case, the damage does not prevent these wagons being shunted.

In some yards there is also a special siding reserved for small wagon repairs, particularly empty high-sided wagons to be sent to the ports. This enables small repairs to be carried out very quickly, and

the wagons can go on their way in a few hours.

CHAPTER V.

Shunting.

10. Preparatory operations.

Shunting, which is the fundamental operation of a marshalling yard, must be so regulated as to avoid any undue retention of the wagons on the reception sidings (which might make it necessary to hold the following trains at the previous station), as well as to ensure that the trains are made up according to as uniform frequency as possible.

For this reason, extreme importance is attached to the preparatory operations before shunting, as the duration of such operations will govern the time that elapses between the arrival of a train and its marshalling. Obviously, there is advantage to be gained by reducing this time as much as possible, for instance by carrying out simultaneously whatever operations can be done together and by suppressing any time delay between consecutive operations.

On the Italian Railways for example, as soon as the train arrives in a reception siding, the examiners examine the wagons while, at the same time, the markers off proceed with the identification of the stock. Immediately these operations are completed,

the entries are made in the register of wagons arriving, the labels and marshalling lists are prepared ⁽¹⁾ the labels are attached (and wagons marked if necessary) and the cuts are uncoupled. (In some less up to date yards, where shunting is by gravity, only the preparatory uncoupling of the cuts is done on the reception sidings, whilst the actual uncoupling is effected by means of a pole, on top of the hump). Any damaged wagons are then withdrawn, as well as any that for some reason or other have not to be shunted; finally the shunting engine goes to the end of the train and pushes it up the hump.

In the Austrian yards, as soon as a train arrives on a reception siding, a marker off proceeds to identify the wagons by checking the papers received from the guard against the numbers on the wagon labels. At the same time he chalks up on each wagon the number of the shunting siding. Another marker off and a shunter follow the marker off: the former prepares the cut labels while the latter uncouples and empties the brake pipes. At the same time, or as soon as the cut labels are prepared, the technical examination of the stock is begun.

The preparatory operations before shunting are carried out in a similar way in Hungary and Czechoslovakia.

11. *Shunting. — Rapid forwarding of registered wagons.*

In order to ensure the best and most regular shunting output, it is necessary, in addition to carefully allocating the marshalling sidings group in order to prevent frequent shunts to clear the stock (especially in the case of sidings used for multiple purposes), to adjust the strength of the staff and the

number of shunting engines to the frequency of the work (accelerated or slowed down), so as to obtain the maximum output in each individual case. Likewise, it would seem advisable to make use of two shunting engines — instead of only one — during periods when the frequency of work is accelerated, in order to prevent loss of time due to the single engine having to return to the reception group, after a train has been shunted, to reach the rear end of the next train to be marshalled.

In practice, the use of a second engine, makes it possible to push the wagons of the following train from the reception siding to the hump before the end of the previous shunt, and thus to begin the next shunt immediately afterwards.

It is also a good practice to carry out successive shunting operations during the period in question, so as to avoid interrupting the work of closing up wagons on certain sidings in the marshalling group. While this may make it necessary to alter the order in which the trains are to be shunted, any delay, caused by such alteration, i.e.: one train being held for a longer period in the reception sidings than one arriving after it, will be amply compensated by the better general output. This method, adopted by the Italian Railways, gives good results.

The Czechoslovakian Railways are of the opinion that, as far as possible, the yard should be organized in such a way that the different operations do not interfere with each other. When, for technical reasons, this is impossible the work must be organized so that any loss of time is reduced to a minimum.

For example, if the shunting is interrupted by the departure of trains, the trains are made to leave in groups. As they leave consecutively at short intervals, the shunting is interrupted for a longer period and operations can thus be carried on without interruption.

The Spanish Railways are of the opinion that, to obtain the best and most regular shunting output, perfect co-ordination of the different staff, both of those giving the orders

(1) The marshalling lists, which are prepared according to the order of composition of the train, show, in addition to the details about each wagon or cut and the shunting siding concerned, a special conventional sign indicating wagons loaded with dangerous goods, wagons with 4 pairs of wheels, wagons with cast iron wheels, etc.

and of those carrying them out, is essential. The running of the trains without delays and the dividing up of cuts are also important factors affecting the regularity of the marshalling.

The Swedish Railways did not report any general method; they adopt different procedures according to local installations, volume of traffic, etc.

The Turkish Railways likewise, do not give any detailed information in this connection, but state that best possible use is made of the notification of expected trains.

On nearly every Railway, certain registered wagons have to be sent forward quickly (such as perishable foodstuffs, express goods, etc.) and must leave the marshalling yard on given trains.

If the wagons are placed at the head of the train, it is generally the train locomotive which takes them to the departure sidings. Alternately, the train may be shunted before the other trains and the wagons in question are put in a special siding from which they are afterwards collected and added to trains leaving. This has a notable effect on the speed with which they are forwarded though, owing to the limited number of such wagons and the fact that they are dealt with in a given siding from which they can be cleared without interfering with any other work in operation, it does not influence the output of the yard to any appreciable extent.

Thus in the Czechoslovakian and Italian yards, one siding in the marshalling group is reserved for shunting such wagons. In Italy, the effect of the operation relating to these wagons on the general shunting output — which is of no practical importance at Milan Smistamento — can be estimated at a 5- or 6 minute interruption to the shunting in several other yards, or on the whole one hour a day.

The Swedish Railways usually deal with such wagons in the same way as all the other wagons. However in certain special urgent cases, they take special steps to ensure that these wagons are included in given trains, sometimes by reserving a

special siding for them. In any case, to facilitate the marshalling, the positioning of such wagons in the train on arrival at the marshalling yard is decided in advance. As there are not many such wagons, this does not hinder the work of the yard.

The same remarks apply in the case of the Turkish Railways who give priority in shunting to registered wagons without causing any appreciable disturbance or loss of time.

In Austria, registered wagons are given a special label and are placed on principle at the head of the train. In addition such wagons are marked in a special way on the shunting lists, which makes it possible to avoid any additional shunting.

In Hungary, the wagons that have to be sent forward in any special way do not usually pass through the marshalling yards; should they do so, they are separated before shunting.

In Spain, no provision is normally made for the rapid forwarding of special registered wagons.

12. *Interruption in shunting : consequences. — Precautions taken to avoid accidents.*

The regularity of shunting depends, apart from the frequency of the operations, on the number and length of interruptions occurring for various reasons or because of accidents.

Of the interruptions due to what may be called normal causes, those involved in closing up the wagons on the marshalling sidings — effected by shunting engine — the departure of a train which impedes the shunting, refuelling of the shunting engines, clearing of the wagons on certain marshalling sidings, and the passing of the train locomotives from the reception sidings to the locomotive shed, are the most important. Other causes of interruptions which must be taken into account are those due to certain accidents, such as wagons shunted onto the wrong siding and shocks to wagons on the different sidings.

In the Italian yards there is no interruption of the shunting for refuelling the shunt-

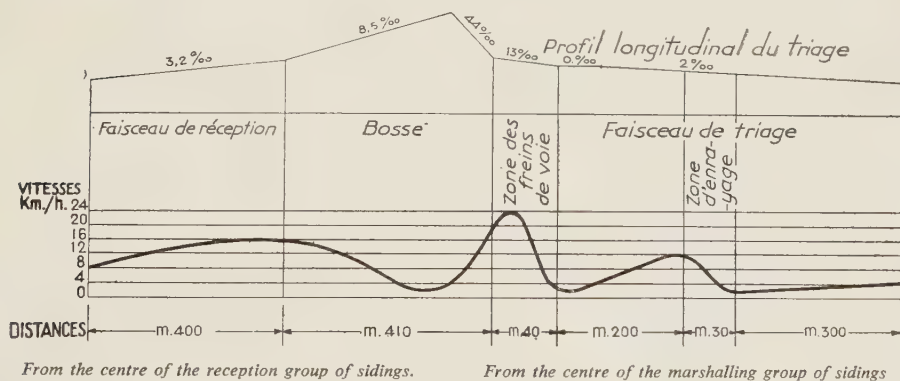
ing engine, as each engine that goes to the shed to refuel is immediately replaced by a spare engine which does the work of all the engines while they are refuelling.

As regards closing up the wagons on the marshalling sidings by means of the shunting engine, the Italian Railways do not use this method on principle, but allocate different engines for shunting than those used for other operations. However when circumstances make it desirable (for example if there is a falling off in the traffic and work is proceeding at a slower pace), use of the shunting engine will likely reduce to the minimum interruptions to the shunting, care being taken as far as possible to carry out these operations in the intervals between two shunts. In any case, these interruptions only last about 8 to 10 minutes.

derailments, damage to the track brakes) in the main yards there is an emergency programme laying down how the marshalling and making up groups of sidings shall be used under such circumstances; in particular, it is stipulated that wagons shall only be closed up on the marshalling sidings between two successive shunts. Less important accidents occurring during shunting are fairly rare in the Italian yards; the number of derailments, which are practically nil under good atmospheric conditions, amount to an average of 0.5 per 1 000 during the winter. The number of shocks due to two vehicles overtaking each other on the same siding owing to faulty braking is also very small.

On the Spanish Railways interruptions to the shunting amount to about 3 hours out of 24, in each group of operations. Refuel-

Diagram showing the speeds on shunting and after retarding in an up-to-date Italian yard.



Explanation of French terms. — Profil longitudinal du triage = Longitudinal profile of the marshalling yard. — Faisceau de réception = Réception group of sidings. — Faisceau de triage = Marshalling group of sidings. — Bosse = Hump. — Zone des freins de voie = Zone in which the track brakes are located. — Vitesses = Speeds. — Distances = Distances.

There is no interruption owing to a train leaving across the shunting area, as the installations at the large Italian marshalling yards and the organisation of the service render all train movements independent of the shunting.

Accidents which may upset the shunting, or more serious still, lead to it being interrupted for a long period, are not frequent. In the most important cases (such as serious

ling of the engines is generally made to coincide with the new shift coming on duty, whilst water is taken in during a few brief intervals in the working hours. Everything is done to reduce wasted time by a constant supervision of the way the work is carried out.

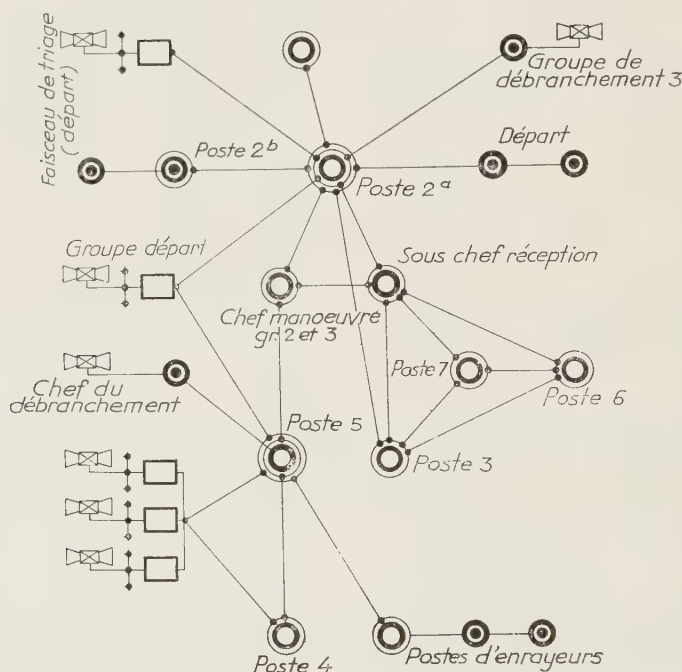
On the Swedish Railways also, there are no interruptions due to refuelling the shunting engine, as electric locomotives are used.

Wagons are closed up on the marshalling sidings mainly by the continuous gradient of these sidings. The number of wagons wrongly shunted is about 0.4 % of the total and the extent of interruptions to the shunting due to any other causes is about an hour a day maximum. In order to prevent wagons overtaking each other, shocks, and the other accidents mentioned, the speed of the cuts of wagons from the hump must be carefully regulated, so that they gradually come to a stop at a given point. For this

fairly satisfactory results in preventing wrong shunts by introducing route labels attached to wagons at the departure station (mistakes have been reduced by 50 %). On the other hand, they suffer from interruptions to the shunting when the limited length of the marshalling sidings or their profile makes it necessary to close up rakes of wagons. This drawback is more serious when the number of wagons to be dealt with is large.

Refuelling of the engines takes place,

Diagram of loud-speaker installations in an Austrian yard.



reason yards equipped with track brakes also make use of hand brakes acting on the shunted cuts after they have been retarded. It is important that the speed of the cuts pushed up the hump should have a given value; the Swedish Railways consider a speed of 2.5 km/h (1.6 m.p.h. approx.) suitable for this purpose.

The Austrian Railways have obtained

in principle, during the change over of shunting staff shifts, but if there is a great deal of traffic, an auxiliary engine is used. Interruptions due to the arrival or departure of trains are practically nil.

Interruptions to the shunting account for about 20 % of the total time spent in marshalling.

The Czechoslovakian Railways endeavour

to reduce interruptions in shunting to a minimum, either by the technical adaptation of the marshalling, or by the organization of the work. Where it is absolutely essential to complete certain operations without upsetting the usual shunting operations, an additional shunting engine is used.

Wagons wrongly shunted are removed from the shunting sidings when the trains concerned are being made up; damaged wagons, or those whose loads have to be adjusted, are shunted onto a special siding during the preliminary marshalling. In general the number of wagons wrongly shunted is less than 1.2 %.

In the Hungarian yards, wagons wrongly shunted are removed from the marshalling sidings after shunting, by the same shunting engine which is used to close up the wagons.

The Swedish Railways use an auxiliary engine which can stand by next to the hump during the shunting and which can be used during interruptions, either to pick up wrong shunts (or wagons which are damaged or need their loads adjusted), or to close up the wagons on the marshalling sidings. In a marshalling yard on a continuous gradient, the above Railways have built a special small group of sidings designed to enable the necessary corrections to be made.

The Spanish Railways, in order to prevent wagons overtaking each other and other accidents, lay down that no wagon (or cut of wagons) may be started until the previous wagon has passed a marker on the siding concerned. The necessary indications for starting the next wagon (or cut), are given by means of optical signals by staff responsible for checking these operations. Such staff is also given skid brakes to prevent wagons running back as well as any violent shocks.

Wagons wrongly shunted or damaged wagons are removed from the shunting sidings by a special operation, which is carried out either at the outlet end, if the wagons happen to be close to it, or when the trains are being made up.

In order to reduce the number of wagons

forwarded wrongly, the label and inscriptions are very closely checked.

Generally the wagons are closed up on the marshalling sidings by the shunting engines, which may be either engines specially allocated to the marshalling sidings for this purpose, or the engines used for shunting, or other locomotives.

In some cases wagons may be manoeuvred by hand.

Correction of loads, when it cannot be effected on the spot, is always carried out on a suitable siding.

All Administrations agree on principle that the limitation of the number of accidents, such as shocks, overtaking and derailment, depends first and foremost on the care and professional skill of the men and on the co-ordination of the different operations for which they are responsible. In this connection, it is imperative that the instructions issued by the managerial staff be clear and be given out in good time, and that the methods of communication (for example loud-speakers) be in proper working order, particularly during the night or in fog.

With regard, in particular to derailments, it is obviously necessary in order to obtain the best possible co-ordination of the work, to have clear understanding between shunters, pointsmen and brakemen.

None of the Administrations which replied to the questionnaire has adopted the practice of pushing wagons on by means of tractors running on paths alongside the track. The Italian Railways are of the opinion that this system, which might be useful in certain special cases, would not be suitable for large marshalling yards, where it is often necessary to close up a lot of wagons on the same siding, as this can be effected more speedily by means of a locomotive. In addition, the number of tractors required might be greater than the number of shunting engines normally used, with a consequent increase in the staff employed.

Finally, paths would have to be provided for these tractors which would mean widening the space between the sidings.

The Austrian Railways, on the other hand consider that the use of tractors might be of advantage where there are a great many wagons as this would enable the shunting engines to be used exclusively for the shunting and making up operations, without their having to be taken off these jobs for others, thereby avoiding possible delays in shunting and making up of trains.

The Spanish Railways are of the opinion that the use of wagon pushing tractors might be useful in large yards where the great length of the sidings makes it difficult for the wagons, particularly heavy wagons, travelling under momentum to contact those wagons already shunted.

CHAPTER VI.

Braking and retarding arrangements.

13. *Methods of braking and retarding. — Staff employed.*

a) *Yards equipped with track brakes.*

The braking of wagons in up-to-date yards is generally effected by track brakes which retard the initial speed of the wagons on leaving the hump; they are brought to a stop on the marshalling sidings by hand operated skids placed on the rails at an appropriate distance.

The up-to-date Italian yards are equipped with 4 mechanical « Thyssen » track brakes, sited at the lead-in to the marshalling group and able to exert a maximum effort of about 100 atm. These brakes are worked from an automatic marshalling box by two employees detailed for this job.

After braking the wagons are stopped by means of one skid, or two if the first proves insufficient (25 to 30 m. apart.) placed by hand on each marshalling siding, the first skid is placed about 200 m (220 yards appr.) from the lead-in to the marshalling group of sidings.

The skids are put in position in different ways according to the object in view (retarding or stopping the wagon) and the weight and speed of the wagons. The results are always closely dependent upon

the professional skill of the men responsible for this job, who are able to estimate from their own experience the characteristics of the wagons being shunted, adopting the most suitable method for each of them. For this reason it is not usually necessary to indicate the braking length to the brakemen. If visibility is bad, the men are advised by loud-speaker of the siding allocated to each wagon shunted, the kind of transport and braking length necessary. In detail, the various lengths correspond to the 5 following braking methods :

1. normal retarding, i. e. for wagons with normal weight and speed : a single skid, applied 4 to 8 m (4.4 yards to 8.8 yards) in front of the first switch rail;
2. long retarding, used in the case of heavy wagons coming down from the hump at a higher speed than normal : one skid applied 10 to 15 m (11 yards to 16 yards approx.) from the first switch;
3. fixed braking, to stop the wagon. In this case, the skid is placed 30 to 35 m (33 yards to 38.5 yards approx.) in front of the desired stopping point; the retarding of the wagon begins 10 or 15 m (11 yards to 16.5 yards approx.) after the skid (according to its weight and speed);
4. double fixed braking, to stop the wagons dead, which is done by placing two fixed skids on the rails of the same line, alternately, about 10 m (11 yards approx.) one from the other;
5. double long retarding, used to stop dead heavy wagons travelling at high speed. The first skid is placed in front of the switch, at the normal distance, and the second placed after the switch in front of the point where it is desired to stop the wagon.

The staff is distributed by allocating two brakemen to each group of 10 sidings in the marshalling group; they are under the orders of a gang foreman who tells them which siding they are to work on, in accordance with the shunting lists.

Wagons which on account of their special construction or the nature of their load

(dangerous or fragile goods, etc.) must not be braked by the track brakes, are accompanied from the hump to their destination siding and braked by screw brakes.

In the up-to-date Austrian yards, braking is done by Thyssen track brakes or shoe type track brakes of the Buessing type; on eman is able to operate two Thyssen brakes or one Buessing brake. The cuts are braked to a stop on the marshalling sidings by skids or by using the wagon screw-brakes. Screw brakes are obligatory on cuts with a total of more than 6 pairs of wheels load or more than 10 pairs of wheels not under load; in such cases the second half of the pairs of wheels must be braked.

The Swedish Railways make use of a hand operated track brake, with skids with double rims. The men responsible for this work are very carefully selected and trained for the job.

Braking to a stop on the marshalling sidings is done by means of various kinds of skids. The men responsible for this work consist of a gang under a foreman placed on one or two lines at right angles to the sidings; the foreman allocates the various jobs amongst the men. (Sometimes however the shunting engines are used to brake the rakes instead of hand brakes, as otherwise it is impossible to effect satisfactory retarding owing to the very heavy traffic with which the Swedish Railways have to deal at the present time).

In the case of certain wagons with which special precautions are necessary owing to their construction of the kind of goods with which they are loaded, skidbraking is not allowed. These wagons, which are specially marked by means of labels as well as on the shunting lists, are retarded, as far as possible, by screw brakes. This is also done when more than two loaded wagons or more than three empty wagons are pushed over the hump at the same time.

The Czechoslovakian Railways also have yards equipped with track brakes where, in order to avoid shocks, the wagons are retarded on the marshalling sidings by means of skids.

b) *Yards not equipped with track brakes.*

In yards not equipped with track brakes and particularly in those where the shunting is done by gravity, all wagons are retarded and brought to a stop by hand.

In Italy hand skids are generally used, and these are applied in the same manner as in the other yards; retarding is effected if necessary in two consecutive stages. Sometimes the cuts have a man accompanying them to apply the wagon screw brakes.

The number of brakemen used in a yard where the shunting is done by gravity is 6 for a total of 22 marshalling sidings.

In the Austrian yards also, shunted wagons are braked to a stop by hand braking or by skids applied by the brakemen, each of whom is allocated 2 to 4 shunting sidings.

In Czechoslovakia, in those yards not equipped with track brakes, these are replaced by suitable rails arranged in such a manner that the skid slides off automatically after the wagon has been retarded on the gradient.

The men responsible for braking are divided into two working groups, i. e.

a) to lay the skids on the special rail mentioned above;

b) to lay the skids on the marshalling sidings.

Generally a brakeman is responsible for 3 sidings.

On the Hungarian Railways which do not have any yards equipped with track brakes, wagons are stopped by means of screw brakes or skids. One brakeman is used for each two sidings.

In general, the brakemen are not given any indication as to the length of the braking to be used, for in every country their professional skill is depended upon.

In certain countries, the usual practice is to bring the wagon to rest short of the preceding wagon in the siding so that the wagon may then move forward by gravity at such a speed as to bring it only very gently on to the preceding wagon (stop

braking). However, other countries prefer the retarding method, particularly with regard to yards equipped with track brakes.

In such a case, the need for stop-braking only seldom occurs, for example when the wagons already shunted onto a siding are in close proximity to the points or when special precautions in shunting have been ordered. In the Italian yards fixed or double fixed braking is applied in such cases as already mentioned : after this, if necessary, the wagon can be gently pushed by hand to the proper stopping point.

In the Austrian yards, when wagons are braked by hand under such conditions, the braking is so regulated that all shocks are avoided. In other cases the wagons are stopped — by means of hand applied skids — close to the preceding wagon, and after the skid is removed they run forward gently owing to the slope of the line till they touch the other wagons. If there is insufficient slope on the line, the wagons in question are pushed on by hand. A similar method is used on the Hungarian Railways.

On the Spanish Railways braking is done by means of skids or the wagon brakes.

Apart from some exceptional cases, requiring special precautions, no particular steps are taken, but the braking is left to the skill and professional knowledge of the brakemen.

The wagon is nearly always brought to a stop near the previous one, and if possible is pushed on till it touches it. In other cases, one of the next wagons is allowed to come up rather faster so that it pushes the separated wagons close together.

14. *Damaged wagons.*

We have already studied the effects of accidents which may occur during shunting (such as shocks and derailments), but without considering the effects of such accidents as regards damage to the wagons; dealing now with this point, we find that the average percentage damage as compared with the total number of wagons

dealt with is very small. In the case of the Italian yards this percentage lies between a minimum of 0.5 per 1 000 and a maximum of 1 per 1 000, whilst in the Swedish yards it varies between 0.2 and 0.3 ‰; in the Austrian yards, it reaches an average of 0.6 ‰ and in Czechoslovakia about 0.25 per 1 000.

The average percentage for the Spanish Railways is 5 per 1 000.

These results, which are practically the same in all the different yards of each Administration depend above all on the selection of the staff responsible for the braking and on the supervision exercised by the management.

The question as to whether this percentage is still lower in yards where braking to a stop is in force does not apply to the same extent for all the Administrations which we consulted, as this method is not used generally.

However, some Administrations have stated that the system has reduced the percentage of wagons damaged in all yards where it has been adopted but while it does appear that the number of wagons damaged under these conditions may be lower than when wagons are merely retarded, the use of braking to a stop may reduce output, owing to the longer interruptions in shunting required close up the wagons as they are liable to stop further away from each other.

CHAPTER VII.

Formation of trains.

On all the Railways consulted, the organization of train formation depends in principle upon the regular train programme for the directions drawn up by the management and changed whenever there is any alteration in the general time-tables. As regards the rules and methods to be adopted for train formation, it is, generally speaking, the yards themselves which make the necessary arrangements, according to the possibilities of the local installations, the staff and shunting engines available.

Thus on the Italian Railways, the marshalling yards, using as a basis the standard composition of each train as per the timetables and taking into account the order in which the trains arrive at the yards, the conditions under which they are shunted and the kind of train on departure, lay down the local instructions to be followed with regard to the composition of the trains in the making up sidings. As regards trains made up of one type of stock, their composition is also covered by the above mentioned programme and no working plan is needed. The stock in question is taken to the departure siding as soon as it has been cleared from the marshalling sidings; it does not concern the making up sidings and is shunted merely in order to couple on brakes and vans.

On the Spanish Railways formation operations are governed by a programme which also covers the parcelling out.

In any case, apart from the established programme, the formation of trains is brought forward when there is a heavy influx of stock for a given direction, so as to relieve those marshalling sidings concerned which are most heavily loaded. On the other hand, when there is not much stock in the marshalling group, the making up of the train is delayed in order to await the arrival of the necessary stock. In general, on all the Railways, reliance is placed on the professional skill of the men under the orders and supervision of the yard masters assistant managers, chief shuntsmen, etc. (In Czechoslovakia, the men posted to the marshalling yards must first receive theoretical instruction and undergo a practical apprenticeship).

The system of « simultaneous formation » is not in use on most of the Railways consulted, though the Austrian and Turkish Railways do use this method as they find it advantageous from the point of view of saving time and marshalling sidings. In particular, the Austrian Railways have made use of it in yards where it is necessary to make up several groups of wagons but where the number of sidings is not sufficient for this purpose.

The incorporation of vans and wagons from the transshipment depot or other local yards and corrections, etc., in the trains is effected after the preliminary formation has been carried out in the making up or departure sidings, by means of shunting engines, unless it is possible to include them during shunting.

The vans are generally held on a suitable siding; they are included normally in all the stopping and local trains, but not always in through trains. It should be noted in this connection that the Swedish Railways have suppressed vans on the long distance through goods trains, the only staff on these trains being the driver and his assistant.

On certain Italian trains running over the electrified lines (trains carrying perishable foodstuffs, empty stock) a van is considered superfluous, and the guard then travels on the locomotive.

Generally, when there are several making up yards, the work is divided up according to a programme prepared whenever the timetables are changed, and according to their specialisation.

In the Italian yards, where the formation of the trains can take place on one or two making up sidings, or on the departure group of sidings, the former are reserved for making up trains consisting of various wagons (i. e. to several destinations), whereas on the departure sidings the homogeneous trains cleared from the marshalling sidings are completed. (This completion consists of adding brakevans, vans and wagons from the local yards adjoining the yard). The work on the making up sidings is carried out in the order in which the trains will leave, for each line.

The Swedish Railways endeavour as far as possible to make up the trains starting from the goods stations near the yards in such a way that the work of the marshalling yard is facilitated. As regards the distribution of the work amongst several groups of sidings, which applies to all those of their yards sited on a constant gradient, 20 % of the trains (10 trains) are made up on the first group of marshalling sidings — whence they are cleared to the departure

sidings — and the others on the actual departure sidings.

CHAPTER VIII.

Shunting engines.

The output of a marshalling yard depends on the general organization and the proper use of the available resources, and in particular on the number and characteristics of the shunting locomotives used. The allocation of the locomotives to the different services and different groups of sidings requires careful selection of the type and power of each engine, taking into account the gradients and the weight of the rakes of vehicles to be shunted, as well as the consumption of fuel and the engine staff required.

All the Administrations follow these principles in selecting the locomotives used, the Austrian Railways also take into account as far as possible the fuel capacity of the engines, in order to avoid have to stop too frequently to refuel.

For shunting or clearing the marshalling sidings, the Italian Railways mostly use steam engines of 980 H.P. They also use diesel-electric 680 H.P. locomotives. For all other purposes they use steam engines of about 500 H.P. Practical experience has shown that of the above two types of locomotives (steam and diesel), the diesel engines, though less powerful, are the better as they have a higher output, which is due to the fact that they are able to develop their maximum power at any given moment, without depending upon the professional skill of the driver. These engines, which may be driven by a single man, also have the advantage of being very light on fuel owing to the high efficiency of the diesel engine and the possibility of stopping the engine when the locomotive is not working.

The Austrian Railways, in view of the present shortage of engines, are not always able to use the engines most suitable for the work in hand. In any case, although they also use electric locomotives, they prefer steam locomotives, especially for shunting, and also in the case of operations on

electrified lines. This preference is due to the fact that steam locomotives stand up better to overloading than do electric locomotives. They are unable, however, to make any comparison between the output of steam and diesel locomotives, as they have none of the latter type at the moment.

The Swedish Railways use electric locomotives of a single type on a large scale, as they have found these better than any others.

The Hungarian and Czechoslovakian Railways use steam locomotives only, the types of these locomotives being determined by local conditions and the average output required.

Shunting engines are usually driven by two men, but the electric locomotives used in the Austrian and Swedish yards only require one man.

The composition of the crews working with the shunting engines is three men on the Spanish, Italian and Hungarian Railways, and 3 or 4 on the Czechoslovakian Railways according to the work; the other Administrations did not give any details on this point.

In the Italian yards, continuity of the shunting whilst the engines are refuelling is generally assured by another engine which takes the place of that which has gone back to the shed to refuel. In the case of less important operations, an engine may be borrowed from another part of the yard.

On the Austrian Railways refuelling, which takes place in the shed, is done between changes of the engine crews and shunters and pointsmen, while watering and greasing is done in the yard while the men have their meal. However, if necessary, a reserve engine is used whilst the other is being refuelled.

The Spanish Railways only use steam locomotives of average power, which are very flexible in operation; hauling capacity being subordinated to manoeuvrability. On principle the engines are refuelled during the change of shifts. Each engine generally

carries sufficient coal for the whole working period. However if some engines have to return to the shed to refuel, they are replaced, if possible, by a reserve engine.

In the case of the Czechoslovakian Railways, continuity of working is assured by replacing engines whilst refuelling, and if necessary by the use of an auxiliary engine. To reduce the loss of time to a minimum, additional refuelling and the cleaning of the ash-box take place where the engine is working.

The Hungarian Railways replace engines during refuelling or interrupt the shunting; as far as possible, refuelling is carried out during the time the staff have their meal.

No reserve engines are required in the case of electric engines; in the case of diesel locomotives, refuelling need only be carried out at intervals of several days, in view of the low consumption of oil and water, and the limited maintenance required.

The use of train locomotives for shunting in the marshalling yards is on a very limited scale.

In the Italian yards, the train locomotives can be used for thirty minutes after the arrival of the train, and, should the case arise, use is made of this period to carry out certain exceptional shunts, such as the transfer of some wagons arriving on the same train to the departure siding if they have to leave by another connection.

The Austrian Railways only use the train locomotives to carry out certain operations, such as withdrawing damaged wagons or wagons with hot boxes, adding a few parcels traffic wagons to the train, or rapidly removing other wagons so as not to interrupt the normal work of the shunting engines. It is not considered advisable to include shunting in the marshalling yards among the duties of train locomotives, as the output of the engine staff on these locomotives would be lower than that of the men on the shunting engines normally used in the yard, who are more familiar with the different parts of the yard and can carry out the same work quicker.

The use of the shunting engines is generally based on a programme prepared for

each period, taking into account the work of each yard. The practical application of the programme, should take account of the real exigencies of service which may vary from day to day (and even in the course of the same day) and from one yard to another.

Supervision of the use of shunting engines is carried out by the yard master or, if necessary, by the yard control post which we have already mentioned.

The latter, which keeps a constant check on the work in progress, is always fully conversant with the requirements of the different parts of the yard and thus able to control their work and if necessary withdraw any engines which appear to be superfluous, or ask the sheds for additional engines. In any case, the management must take steps to prevent — as far as possible — the engines standing idle for any period.

In the case of the Austrian Railways it should be noted that apparatus known as the «Chronedographen» has been fitted to the shunting engines to record all the work done, so that the output of each engine can be closely checked.

In every country, the proper utilisation of the engines is checked at a higher level — continuously or from time to time — by the operating department, according to the number of hours of work as compared with the number of wagons dealt with.

CHAPTER IX.

Economies to be realized when the number of wagons to be dealt with is less than the complete capacity of the marshalling yard.

15. Measures to be taken when there is a temporary reduction in the traffic.

Marshalling yards have been designed to deal with a very large number of wagons and their normal organization depends upon having a standard method of working which alone will ensure that the costly installations of these yards, and the very considerable amount of equipment and staff

required to work them, will be used efficiently. Cost of labour forms one of the heaviest items in marshalling yard costs, and becomes heavier still when all the yards are not working at full capacity.

It is for this reason that when unfavourable circumstances result in a reduction of traffic, the working conditions of the yard are affected, and its output likewise falls off.

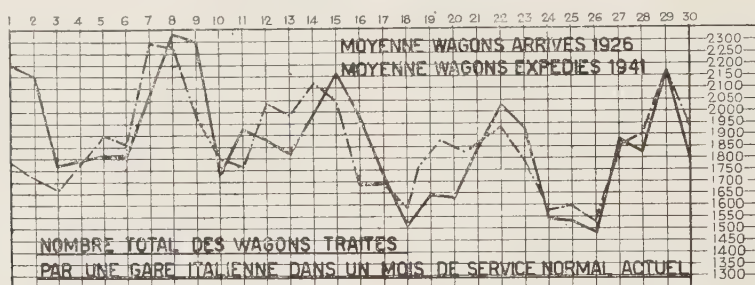
The obvious solution in such cases is for the equipment and staff used in the yard to be cut down in proportion to the reduction in traffic, but for various reasons, this is not possible in most marshalling yards, so that it may become necessary to retain an unduly extensive and costly organization although the traffic has declined.

The Spanish Railways are also of the same opinion, although so far the question has not arisen in any of their marshalling yards, as their capacity is fully taken up and even frequently exceeded by the traffic.

In some Italian yards, a method has been adopted by which shunting is suspended during certain hours of the day, intensifying the work during the remainder, whilst in Hungary marshalling is stopped if necessary during a certain period.

Both these methods may be of advantage in producing economy, particularly in the use of the shunting engines, and they can even be applied simultaneously, depending upon the nature of the traffic and the concentration of trains arriving and leaving. On the other hand the above methods have

Total number of wagons at present dealt with by an Italian yard during one month's normal work.



Average number of wagons coming in 1926.
Average number of wagons sent out in 1941.

If the reduction in the traffic merely occurs on certain days of the week, or during a brief seasonal period, obviously it is impossible to adopt any measures of a final character, but maximum economy must be sought without any too extensive modification being made to the structure and organization of the work.

In such cases a good method appears to be to slow down the output of the yard, by reducing the number of engines and shunting gangs : this is the method adopted by the Hungarian, Italian, Swedish and Czechoslovakian Railways.

the drawback of leading to delays in transit time for some traffic. In addition, while savings can be made in the shunting engine hours, when shunting is suspended for less than a complete shift, it is impossible to save on labour.

The Czechoslovakian Railways also have recourse, in addition to the above mentioned method, to shortening where necessary the working hours in some parts of the yard. In this case, they modify the duties of the different marshalling yards, in order to prevent any increase in the transit times for the wagons.

If the reduction of traffic only occurs on one or two days of the week, it may be a good plan to adopt special methods, such as closing down certain parts of the yard and suppressing a certain number of trains.

On the Swedish Railways, for example, where no parcels are accepted or delivered on Sundays, the number of trains run on Mondays can be reduced, and the time tables do in fact show only a limited number of trains on these days.

The bare minimum of trains are run, such as essential local trains, which on the other hand, are not run on holidays. In the marshalling yards, the working programmes are adapted to meet the above circumstances, so that fewer staff are on duty on Sundays and Mondays.

In the same way, the Czechoslovakian Railways cut down the working hours of certain parts of the yard and suppress some of the regular trains, especially those from the industrial centres, which would not be utilised to full capacity.

The Hungarian Railways also suppress some of the trains serving the yards in mining districts, as the mines do not work on Sundays.

The Italian Railways cannot make use of similar methods owing to the great distances between the south and north of Italy, as they would delay unduly the delivery of traffic accepted during the week and still on its way on Sunday.

In view of this unfavourable circumstance, the services are maintained on Sundays, and goods can be loaded and unloaded on that day. However in one marshalling yard with a specialised service (depending upon the work of a large maritime port) this method is in force, as work at the ports stops on Sundays. In general the Italian State Railways are in favour of a complete shift being suppressed, and investigations are in hand for the practical application of this method.

In Spain also Sundays are taken as working days for the loading and unloading of goods. If however days of little traffic do occur, some of the shunting engines are withdrawn during the most suitable hours.

As regards the suppression of trains, a plan prepared in advance has been adopted which also makes provision for the running of special trains.

On the Austrian Railways if the reduction in traffic lasts for at least a week, the number of shunting engines is reduced, as well as the number of employees, and advantage is taken of the fact to let the staff take any time off due to them. If the reduction in traffic continues over a longer period, one sidings' group is closed.

Slowing down the output of a yard is not retained as being advantageous either from the economic or technical points of view. On the same Railway, stopping goods trains are suppressed on Sundays and holidays and the service is worked by means of a few special trains. This method has the advantage of saving all the labour required for the goods depots and part of the train staff.

16. *Methods to be adopted during a prolonged period of low traffic.*

When the reduction in traffic is not limited to a short period but on the contrary appears to be of a lasting nature, a much more serious problem occurs, i.e.: to decide whether some marshalling yards shall be closed, either completely or partly.

Such a step seems of particular gravity, and before it is adopted, the question must be studied very thoroughly from every aspect, both as regards the position of the railway system, the number of marshalling yards, their geographical position, their duties, the nature and direction of the traffic currents, etc.

If the closing down of a marshalling yard and the transfer of its work to other yards can be effected with less difficulty on railways where there are several such installations, it is nearly always impossible to accomplish on those railways which have a limited number of yards, situated fairly far apart and equipped with important installations to meet important and well defined traffic requirements.

For this reason the Italian Railways

have not as yet considered adopting any such solution, although for some time their marshalling yards have not been working to full capacity. However present circumstances do not warrant such a serious step which would involve, in any case, a thorough preliminary study of possible deviations in the traffic currents, the preparation of appropriate time-tables, etc.

The Swedish Railways which only have six marshalling yards of any size, are also of the opinion that such measures are difficult to take in advance since they depend upon circumstances. If necessary they might consider reducing the activity of one or two of the yards by transferring some of the services to other yards, rather than close them down completely.

The Austrian, Hungarian and Czechoslovakian Railways are of the opinion that if a serious reduction in the traffic lasts a long time, it would be opportune to close down certain marshalling yards, either partly or totally. In such cases, they would consider preparing a new working programme, transferring the services of the yards or parts of yards which have been closed down to others.

Naturally any decision would be made with reservations, taking into account the probable length of the reduction in the traffic and the real economy obtained by

this step. In every case, side by side with the advantages to be obtained, account must be taken of the possibility of serious drawbacks (for example delays in the turn round of stock) which might cancel out or appreciably reduce the benefits accruing from this measure.

The Spanish Railways, whilst considering that it is very difficult to close any marshalling yard temporarily under present conditions, are of the opinion that if there is a permanent reduction in the traffic, they might cut down the number of shunting gangs at work on certain days.

Taking into account the various situations and divergent opinions expressed by the Administrations, we feel that, on principle, the best method is to suppress one or even two shifts a day which, whilst making for a real saving in labour and shunting engines, enables the yard to be kept open and to resume normal work as soon as the traffic situation improves.

However we are of the opinion that it is not possible to decide from general considerations whether the partial or total closing down of a marshalling yard will be justified. On the contrary it seems to us that the advisability of this step should be established by practical experience and after a thorough examination of the numerous factors which come into play.

INTERNATIONAL RAILWAY CONGRESS ASSOCIATION

15th. SESSION (ROME, 1950).

QUESTION XI.

Organisation and development of medical and social services with partnership of the staff in their management.

REPORT

(Austria, Belgium and Colony, Denmark, Spain, Finland, France and Colonies, Greece, Hungary, Italy, Luxemburg, Norway, Netherlands and Colonies, Portugal and Colonies, Sweden, Switzerland and Turkey),

by Dr. HUYBERECHTS,

Directeur Général adjoint de la Société Nationale des Chemins de fer belges.

I. GENERAL REMARKS.

The questionnaire which served as a basis for the compiling of this report was sent to 81 different Administrations. 47 replies have been received. Of these, 31 replying to all or part of the questionnaire, supplied some useful and interesting information.

The 16 others comprise first of all certain Administrations such as the « Compagnie Belge de Chemins de fer et Entreprises » (188 km), the « Compagnie Générale des Voies Ferrées d'intérêt local » (France, 441 km), the « Chemins de fer de Madagascar » (859 km), the « Chemin de fer de la Méditerranée au Niger » (275 km), and the five small Railway Companies in Sweden, which are separate from the State Railways (and whose respective track lengths are 173, 171, 133, 300 and 238 km), who do not have a

medical social service organised, or who are in the process of organising one.

The « Chemins de fer de la Fionie Méridionale » have been absorbed by the Danish State Railways.

In the case of the « Chemins de fer des Alpes Bernoises » (253 km), they have simply stated that their system is identical to that of the Swiss Federal Railways.

The Dutch East Indies Railway Company has replied that no information was available.

Finally, various Administrations — « Chemins de fer du Bas-Congo au Katanga » (2 468 km), « Chemin de fer du Congo Supérieur aux Grands Lacs Africains » (849 km), « Chemin de fer du Maroc » (1 091 km), « Staatsspoorwegen in Indonesië » (4 350 km) — were able to give some fragmentary and extremely condensed indications.

Among the 31 Administrations having

supplied complete answers (or almost complete) it must be pointed out, according to the development of their network: 4 Administrations counting more than 10 000 km, 4 others counting less than 10 000 km but more than 5 000 km. Finally 12 replies from Administrations which exploit a network of from 1 000 to 5 000 km.

The questionnaire which was submitted to the Administrations was divided into groups of questions — these groups, II in number, are repeated below, in each case at the beginning of the replies.

The object of the enquiry was to gather information on the following points:

- the existence of an organised medical and social service, these services being autonomous or independent of the Government system, or eventually based on this system, that is to say, subjected to or incorporated in it. The characteristics of the legal system;

details as complete as possible on the organisation and working of the medical and social services. The activities peculiar to each one of these services. Sectors in which these activities are being exercised or are in preparation;

- precise information on the financing of the medical-social services, and the management of funds. Are all costs left to the Administration, or does the personnel pay a part of these?

What are the rights and the responsibilities of these latter in the organisation, granting of advantages, repression of abuse, the attribution of new benefits or the fixing of the rules for attributing existing benefits;

- what are the reasons for satisfaction or discontent resulting from the present system and what new developments or modifications to the present system are intended?

II. REPLIES OF THE RAILWAY ADMINISTRATIONS TO THE QUESTIONNAIRE.

GROUP 1.

1. *Is there in your country a system of social security, collective and mutual help fixed by law?*
2. *Is this system compulsory?*
3. *When was it created?*
4. *What are the main principles by which it is ruled?*
5. *What changes have occurred since its creation and especially since the last world war?*
6. *Is there in your country an enacted system for indemnifying victims of work-accidents and sufferers from professional diseases?*
7. *Is this system compulsory?*
8. *When was it created?*
9. *What are the main principles by which it is ruled?*
10. *What changes have occurred since its creation and especially since the last world war?*

ANSWERS.

1. Austria.

Federal Railways.

All branches of social insurance are fixed by laws; the system is compulsory. It was created for accident-insurance and health-insurance in 1887, for employees insurance in 1926, for disablement in 1939.

The main principle is the distribution of costs between the employer and the worker. For accident insurance however the charges are entirely supported by the employer.

After the liberation, as the German organisation was no longer adequate to meet existing conditions in Austria, the social insurance underwent a certain reorganisation.

There is in existence, a law which was passed in 1888, on accidents at work, which is compulsory, and which imposes all insur-

ance charges on the employer. Since the war certain additions have been accorded and regulated on legal bases.

2. Belgium and Colony.

a) *Société Nationale des Chemins de fer belges.*

There is in operation, a compulsory scheme of social insurance, which was created by the law of the 28-12-44, and which has for its object: to insure the worker against the different risks to which he is exposed (illness, old age, unemployment, disablement) — to increase his family allowances — to grant to the worker paid annual holidays — to extend compulsorily the health insurance to the members of the workers families.

This system has not undergone any noticeable change.

Compensation for accidents which happen at work, and illnesses which result from exercising a certain profession, are regulated respectively by the laws of the 24-12-03 and 24-7-27. This system is compulsory. The legislation is based essentially on the principle of the professional risk and the contractual and partial indemnification.

The ceiling for the application of the law on accidents has been raised several times: it is fixed at the moment at 60 000 Belgian fr. The compensation for permanent disability is calculated on the 2/3 of the daily salary instead of a half (80 %: for severely injured people who need the help of another person). In addition the benefit of the law has been extended to employees and domestic staff. The same modifications have been included for illnesses incurred in the course of duty.

b) *Société Nationale des Chemins de fer vicinaux.*

Same reply as the S. N. C. F. B.

c) *Otraco.*

There is a legal system of social insur-

ance which differs for the European and the native. It was created after the last world war, except for unemployment pay for Europeans (1940) and the work contract for natives (1922).

The employer assures the social security of the employee, without the latter making any financial contribution, except for his pension. The benefits of the scheme are extended to all employees irrespective of sex or nationality.

There is no financial intervention on the part of the colonial Administration, except for unemployment pay.

Compensation for accidents and illnesses which result from the workers' job or trade, is applicable only to Europeans, and not to the natives. The system is compulsory and was created after the last world war.

All employees benefit from the scheme. The ceiling is 120 000 fr.; compensation reaches 2/3 of the loss of salary up to 48 000 fr. and 20 % of the loss which exceeds this figure. The employer must insure himself at the offices of the colonial funds for disabled persons. The ordinary subscription is fixed by law, and there is an extra subscription of 1 % for the employee and 2 % for the employer.

It is only for illnesses resulting from a trade that the ordinary subscription has to be paid by the employer alone.

3. Denmark.

State Railways.

The law passed on the 20-5-1933 installed a partially compulsory system regulating security and national solidarity, accident insurance, and unemployment insurance.

Benefits are granted to everybody, by the treasury, for the entire stay of absence due to illness, cure and medical treatment.

The national solidarity recognises the right to disablement pension for illness, and old age pension.

Accident-insurance: every worker is insured; he has the right to treatment, a daily allowance and a disablement pension.

Eventually compensation to next of kin and funeral expenses.

Unemployment-insurance : this is paid for by a recognised fund which is subsidized by the treasury.

The payment of a daily allowance to the victims of an accident has been fixed for the 7th day instead of at the end of the 13th week.

4. Spain.

*Red Nacional
de los Ferrocarriles Españoles.*

There is in existence a sanitary and a health-insurance scheme which were imposed by the law of the 14-12-42.

The sanitary service grants medical and pharmaceutical aid to workers and members of their families.

The health-insurance gives protection to the lower paid workers against the risks of illness (compensation for illness — maternity, funeral expenses).

No modifications have been made to the scheme since the last war.

The R. E. N. F. E. has not supplied any information with regard to accidents which occur at work, and illnesses which result from a trade.

5. Finland.

State Railways.

There is no general law but there are several bye-laws (public assistance, for the blind, for war widows and orphans, help in maternity, communal homes, accident-insurance, etc.). This system which is of a compulsory character, is governed by the decree of 1852 and various laws which were voted between 1922 and 1948. The object is to prevent the need for assistance by a re-education.

The compulsory insurance against accidents caused at work and illnesses resulting from a trade is governed by the laws of the 20-8-48 and the 12-4-39. The Railways are exempted from insuring their

personnel but are obliged to respect the system of compensation. The injured person receives medical attention, a daily allowance and a lump sum which is fixed in relation to the body injury. Where necessary the members of the family are entitled to an aid pension and compensation for funeral expenses.

6. France. — Algeria and Tunisia. Colonies and Protectorates.

a) *The French National Railway Company.*

There is in France a compulsory system of social insurance for all salaried personnel, and this is being extended to the entire population. It was created by the law of the 5-8-1928 and came into force the 1-7-1930 — the family allowances were not made compulsory until 1932, whereas accidents at work were already covered by the law of the 9-4-1898.

Since then all this incongruent legislation has been re-grouped under one law only, which is known as « of social insurance ».

The French system of social service is based on the principles of the Atlantic Charter (art. 5) and on the recommendation of the B. I. T. (solidarity on a national scale, re-distribution of income, etc.).

The French system achieves uniformity of the social security from the point of view finance and Administration as well as technique :

- allotment of the majority of votes to the representatives of the members in the C. A. the social security funds, the other members of the C. A. being employers' representatives and technicians;
- adoption of the system of distribution;
- proportioning of money payments to the salaries which are used as a basis for calculating the subscriptions;
- realisation of a system of cover which is particularly wide, of the risk termed « of long illness ».

Since its inception the system of « accidents to workmen » was incorporated

in legislation concerning social security. Furthermore social and sanitary activities have been developed with a view to prevention. Finally the system of contributions has been improved in many ways.

The law of the 9-4-1898 provided for a system of reparation for accidents to workmen, and from sickness resulting from a trade, based on the responsibility of the employer, the insurance being optional and contractable with an insurance company.

Recent legislation (law of 30-10-1946) included the risk of accidents to workmen within the limits of the social security service. Since the last war, the legislation has been noticeably modified, especially concerning accidents which occur on the way to and from work.

b) *Régie autonome
des Transports parisiens.*

There is a general system of social security fixed by the law of the 4-10-45 in which wage-earners of all professions take part. This is compulsory. The object of this system is to protect the worker against various risks: sickness, maternity, disablement, old age and death. It imposes on the worker and the employer a contribution to cover the above mentioned risks.

Recently there was a re-organisation of the Administration of all the different institutions which deal at the present time with the management of existing social laws.

All contributions due for social insurance are grouped into a single payment which is made by the employer to the social security funds, who in turn are required to distribute this money to the different Administrations, corresponding to the different risks. This insurance was extended first of all to all salaried workers, then to all independent workers, and finally to the entire population.

The law passed the 9-4-1898 governs the compulsory insurance of all salaried workers against the consequences of injury and

illnesses inherent to the exercising of certain professions. The cover of this risk is paid exclusively by the employer.

The law passed the 30-10-46 imposes the cover of the workmen's accident and professional sickness risks by the national security scheme, on payment of a contribution, which is variable according to the professions involved, by the employer exclusively. Only a few enterprises which are of a national character have retained the right to be their own insurers.

c) *Algerian Railways.*

There is no legal system of solidarity or social security in Algeria.

On the other hand the law of 9-4-1898 and subsequent laws have enforced compulsory insurance for workmen's accidents since the 25-9-1919.

The law of the 25-10-1919 on professional sickness is applicable in Algeria.

The legislation is based on the following specifications:

- professional risk (the responsibility of the employer is engaged without it being necessary to discover the cause);
- the contractual character of the compensation;
- impossibility for the person concerned to have recourse to the system of indemnification of the common right.

The law of the 1-7-1938 extended the benefits of this law to all salaried people bound by a contract.

Since the last war, and especially owing to the currency devaluations, numerous modifications have been made with a view to re-adjusting the subscriptions and incomes.

d) *Gafsa Railways.*

There is no legal system of solidarity or social security in Tunisia.

The French law voted the 9-4-1898 on accidents to workmen was made compulsorily applicable in Tunisia on the 15-3-1921.

The injured person draws half pay. All medical expenses are charged to the employer, but not dental expenses.

e) *Compagnie fermière
des Chemins de fer tunisiens.*

Identical reply to that of the Gafsa Railways. They point out however, that there are special arrangements for the payment of a life annuity to lawful claimants of Tunisian subjects who leave several widows or orphans.

f) *Railways of French Equatorial Africa.*

No reply to questions of group I.

g) *Railways of French West Africa.*

There is no legal system of solidarity or social security in French West Africa.

A decree of the 2-4-1932 made compulsory the provision, for victims of professional illness, or workers accidents, of compensation for temporary or permanent incapacity, medical and pharmaceutical attention, hospital expenses and compensation to lawful claimants in case of death.

No modification has been made since the war, the decree of the 2-3-1949 not being applicable in French West Africa.

h) *Franco-ethiopian Railway.*

There is no legal system of solidarity or social security. Neither is there in Ethiopia a system of compensation for workmen's accidents or sickness through the application of a trade. On the other hand there is a law which favours natives, on the French Somali coast. This system which is compulsory, was created in 1936. It provides for the payment of incomes for permanent disability. In the majority of cases these incomes are compulsorily converted into capital.

i) *The Colonial Railways of Indo-China.*

There is no legal system of solidarity or social security in Indo-China.

Compensation for workmen's accidents and for professional diseases has been compulsory since 1927 according to the regulations fixed by the French laws on the subject.

7. Greece.

a) *State Railways.*

A legal system has been in existence since 1861. Laws and decrees passed from 1922 to 1926 have instituted social security in the proper sense of the word, with compulsory insurance (sickness — old age — death).

The Greek State does not allow enterprises to use their own initiative, and imposes the security which is appropriate to each category of assured persons. Affiliation to social insurance organisations is compulsory for everybody doing a paid job.

The social insurance comprises : health-insurance, old age, disablement, death.

Medical assistance is also given to members families. Members may if they wish, take out a complementary insurance with an independent company. These companies assure a complete or complementary pension, or a partial allowance for sickness, disablement, death and in certain cases, for unemployment. In addition to the payment of wages and free, or partially free medical and pharmaceutical assistance (given up to the time the company's doctor decides that the patient may start work again), the company grants pre-natal examinations, free confinement, etc. All these benefits are extended also to the members of the family.

This system has not undergone any change since the war.

The system of compensation for workmen's accidents, and sickness caused through a trade is compulsory and has been in operation since 1914. Since the war the minimum rates of compensation have been raised.

b) *Chemin de fer
Pirée-Athènes-Péloponèse.*

Since 1932 a compulsory system has governed the questions of health insurance, disablement, old age, death. Some modifications are under consideration.

8. Hungary.

Hungarian State Railways.

There has been in existence in Hungary since 1891, a compulsory scheme which is general and uniform.

This system has been modified at various times, the most important changes having been made after the last world war.

Thus today, contributions against illness are paid exclusively to the social service by the employer. The members of the worker's family have a right to the benefits granted by the social service, and these rights have been greatly extended. Agricultural workers come under the scheme, their benefits have been increased considerably and their claims to benefits have been greatly facilitated.

There is also a law which covers workmen's accidents and sickness caused through a trade (Decree IX of 1907).

Decree XXI of 1927 settles compensation for accidents. The principles are:

- accident allowance for incapacity of over 10 %;
- certain reduction clauses;
- free medical and specialist treatment;
- allowance for the widow, orphans and grand-parents;
- funeral expenses and other sundry advantages.

Since this date compensation has been extended to sickness caused through exercising a trade, and accidents which occur going to and from work. Other modifications have been made to the compensation to members of the family, infirmity allowance, and the period in which these payments may be received has been extended from 3 to 5 years.

9. Italy.

State Railways.

Different laws and dispositions govern the compulsory regime of health insurance, accidents, unemployment, disablement, old age, etc.

Accident insurance has been laid down since 1898; disablement, old age and unemployment since 1935, and health since 1947.

The compulsory health insurance scheme provides for: medical and pharmaceutical aid, hospital expenses (this applies also to members of the family), compensation for a fixed period.

The age at which the old age pension becomes due is fixed at 60 years for men and 55 years for women.

An insured person whose earning capacity is reduced by at least 1/3 is considered unfit for work.

Since the war, this system has been greatly perfected and is being widely extended.

Compensation for workmen's accidents and sickness caused through a trade has been fixed since the 17-3-1898. The system is compulsory. It provides for treatment, supply of appliances and compensation for all accidents which become fatal, or which cause a permanent disability of more than 10 %, or which cause a total temporary disability of more than 3 days.

Since 1898 different modifications have been made: — automatic insurance of the worker — adaptation of compensation to prevailing conditions — payment of compensation in the form of income — revision every 10 years — special assistance for the seriously injured — sickness caused through applying a special trade has been incorporated into the workmens accident scheme.

Since the last war the workmens accident and professional sickness insurances have been extended to include office, technical and administrative personnel.

10. Luxemburg.

Luxemburg National Railway Company.

The legal compulsory regime came into operation:

- in 1901 for health insurance;
- in 1902 for workmen's accidents;
- in 1911 for disablement and old age;

in 1921 for unemployment pay;
in 1924 for health and security of personnel;

in 1931 for pensions for private employees.

It provides for, *in the case of illness*: free medical and pharmaceutical treatment, an allowance in case of inability to work — confinement expenses — funeral expenses;

in the case of accident: payment of damages — indemnification for prejudice resulting from a wound or from death;

old age-disability: a pension to all workers, aids, apprentices and servants whose pay is not above a certain figure — and also to survivors;

private employees: a pension if they work on the basis of a long-term engagement;

unemployment pay: an allowance according to the state of poverty;

health and security of personnel: salubrity of places of work, and supervision of safety measures.

A law voted in 1925 provides that employees of the State and County Councils are not subject to compulsory insurance.

11. Norway.

State Railways.

The compulsory health insurance regime was inaugurated in 1894, unemployment insurance in 1931.

All employed personnel who do not earn more than 9 000 Norwegian crowns per annum must pay a premium against possible unemployment, (1/2 % of salary) and be affiliated with a sickness fund.

The law of 1931 governs workmen's accidents and sickness caused by a trade. It is compulsory. By it, the payment of the premium, which is variable according to the class of risk (28 classes) is made exclusively by the employer. Thus Railway workers are classed as risk No. 7 the premium for which is fixed at 16 ‰ of the salary: on the other hand for class 28 the premium rises to 200 ‰.

The victims usually receive:

- a variable sum for each day of disablement;
- all medical and pharmaceutical expenses, hospital expenses, etc.;
- a pension in case of permanent disablement (maximum 3 000 crowns per year).

Various modifications have been introduced since the war to counteract the cost of living.

12. Netherland.

Netherlands Railways.

There is no general regime but there are certain special laws on accidents, disablement, old-age pensions, medical and social assistance in case of illness, family allowances.

The regime is compulsory except for old age pensions.

The first law (accidents) date from 1901 — the others were voted between 1919 and 1947.

The system provides for:

assistance in sickness: medical and pharmaceutical attention, hospitalisation, convalescence in sanatoria, dental attention, artificial limbs, compensation for loss of pay, confinement allowance;

old age pensions: from 55 to 65 years of age (optional assurance). The question of making this insurance compulsory is being considered;

family allowances;

accidents: medical and pharmaceutical aid, appliances, compensation;

disablement: subsidies (reliefs).

In 1948 the payment of sickness compensation was extended from 26 to 52 weeks and treatment in sanatorium granted for an unlimited period.

There exists a national insurance fund for workmen's accidents. The Dutch Railways are their own insurers and organise their own medical service for giving treatment to the injured.

Since 1921 the benefit of the law has been extended to all enterprises and includes accidents which happen on the way to and from work.

It was decreed in 1928 that any enterprise has the option of forming a recognised medical service.

In 1946, the salary ceiling was raised for the calculation of compensations or accident indemnities as well as professional sickness. In 1949 the benefits of the law were extended to other kinds of professional sickness.

13. Portugal and Colonies.

a) *The Portuguese Railway Company.*

The legal regime which is compulsory has been in force since the 16-3-1935. It lumps together medical assistance, health aid, old age and disablement pensions, family allowances and life insurance.

The construction of cheap houses and apartments has been added to the scheme since the war.

The law of the 27-7-1936 imposes insurance against workmens' accidents, and professional sickness. It also provides for medical assistance, compensations or pensions.

b) *Mozambique. — State Railways.*

A law voted in 1914 allows the insuring of employees with a national pawnbroking establishment.

It provides for an old age pension, the payment of funeral expenses, and in case of death, a pension to the workers' family.

Since 1937 this insurance has been compulsory for all government employees, and optional for workers.

Since 1937 accident and professional sickness insurance is compulsory for all employees and officials engaged by contract. The person concerned is entitled to full salary until such a time as he is cured, and in case of permanent disability receives a pension which cannot exceed 2/3 of his salary.

14. Sweden.

State Railways.

There is no general law, but there are several special laws which make compulsory old age pensions, compensation for workmens' accidents and professional sickness, help during maternity, baby welfare, etc.

A law which has been in force since 1901, and which was amended considerably in 1916 deals with the questions of workmens' accidents, and professional sickness.

Compensation is based on the reduction in revenue. Expenses are covered by premiums which are paid exclusively by the employer.

15. Switzerland.

a) *Federal Railways.*

Federal laws govern insurance for old age and dependents (1946) sickness and accidents (1911 — came into force 1918) the struggle against tuberculosis (1928). Only the laws which govern old age pension insurance are not compulsory.

They provide for:

insurance for old age and dependants: a pension from the age of 65 years — pensions for widows and orphans. Subscription: 2 % each for worker and employer;

health insurance: compulsory for everybody or for certain categories (according to sub-districts).

Free membership with health insurance funds, under certain conditions. These funds are subsidized by the State;

insurance against tuberculosis: special measures to fight the scourge and help members who have tuberculosis.

The health insurance law is being revised.

Accident insurance has been compulsory since 1918 (law of 1911). It provides for free treatment and payment of 80 % of salary (max. 7 800 fr.) as well as settlement of disablement pensions.

b) *The Bernese Alps Railways*
(Bern-Loetschberg-Simplon).

Federal laws have created a help and pensions fund (1889) as well as a health insurance and accident fund (1911). The system is compulsory.

A pension can normally be had at 65 years of age, or earlier in some cases (disability — female employees — etc.).

The pension is calculated on the number of years membership. It can be reduced, abolished (for misconduct), repurchased (at the request of the beneficiary — an exceptional case).

Survival pensions are granted to widows and orphans.

Contractual compensation in the form of capital is provided for in the case of a man who is compelled, for disablement reasons, to discontinue his functions before his sixth year of membership; to a man who is sacked through no fault of his own; — or paid to his widow.

An allowance to compensate lack of remuneration is granted in the case of temporary disability caused through illness:

officials and employees: 4 months at 75 %, then 50 % up to the time of re-starting work or granting of a pension;

workers: 6 months at 75 %, then 50 %.

Lastly, the law provides for optional subsidies (according to the financial situation of the fund) and an allowance in the case of death.

The health-insurance fund grants, medical and pharmaceutical treatment, hospital expenses, dental treatment (except mechanical dentistry), X rays, massages, confinement allowance, etc.

The system of insurance against workmen's accidents, and professional sickness is compulsory and was enforced by the law of 1911; it provides for medical and pharmaceutical treatment free, disability pensions, pensions for survivors, and funeral expenses.

The statutes were modified on 1-1-1947.

c) *Emmenthal-Burgdorf-Thun Railway*.

Same information as that supplied by the Federal Railways.

16. Syria.

The Damas-Hama Railway and extension.

A compulsory system was inaugurated in Lebanon in 1937 and in Syria in 1943. At the beginning it provided only for an allowance in case of sacking. Since then, unemployment, sickness and paid holidays have been included.

Since 1943 allowances for workmen's accidents and professional sickness have been exclusively the employers responsibility. An allowance is provided for in the case of death or disability.

17. Turkey.

State Railways and Ports.

A system which is of a compulsory nature has been applied since the 19th century for government workers, and for private workers since 1937. The two categories are quite distinct.

In addition, the permanent state Railway employees benefit from a special law which assures them payment during sickness, paid annual holidays, unemployment pay following an accident, old age pension or pension for premature disablement, family allowances, an allowance for birth and death, a pension to the widow and to orphans.

Non permanent workers are affiliated to a security fund and insured against workmen's accidents, professional sickness, and maternity.

Pension rights for all State personnel were made uniform at the beginning of 1950, and all the different funds were amalgamated.

In addition, a pension fund was created for private workers.

Since 1946, the insurance scheme against workmen's accidents, has made it compul-

sory for all employers, even the State, to pay a monthly premium according to tables which are fixed by the Ministry of Works.

It provides for allowances in cases of permanent or temporary unfitness, reimbursement for teeth extractions, travelling expenses incurred for following treatment, funeral expenses, pensions to lawful claimants, etc.

GROUP 2.

1. *Does the legal system of social security, collective and mutual help apply to your Administration?*
2. *If so, imperatively, or with some freedom left to you?*
3. *If not, on certain conditions or with full freedom on your part?*
In the latter case, please tell us whether your Administration has created on its own initiative :
 - a) *medical services;*
 - b) *social services.*
4. *Give a general historical record of those services. Point out the main alterations in their structure since their origin.*
5. *Does the legal system for indemnifying victims of work-accidents and sufferers from professional diseases apply to your Administration?*
6. *If such is the case, is the system of relief granted to victims of work-accidents and sufferers from professional diseases part of your medical and social service or does it form a special service?*

REPLIES.

1. Austria.

Federal Railways.

The legal system of social security and solidarity is applicable without restrictions or latitude. The same applies to the legal system of allowances for workmens' accidents and professional sickness. This latter is dealt with by the Railway Insurance Company who make these payments in place of the public service. They do of course resort to advice from specialised physicians.

2. Belgium and Colony.

a) *Belgian National Railway Company.*

The legal system of social security is not applicable to statutory personnel, but is, and imperatively so, to temporary personnel. There is no legal system of social solidarity.

The Administration is held to procure in general, for its statutory personnel, advantages which are at least equivalent to those laid down by the legal regime.

The Administration has created, on its own initiative medical and social services which comprise social security and solidarity movements.

Before 1929 the medical treatment of employees was intrusted to doctors, who were agreed by the Minister, on the advice of the « Workers' Fund Commission ». Free treatment was only granted to victims of an accident at work and to members who applied to an agreed doctor. Agreed and military chemists have the monopoly of supply of medicines. The hospitals and clinics to be used were laid down by the Administration.

Since 1929 a system of social insurances has been inaugurated in favour of all statutory employees whether still working or pensioned: previous advantages have been considerably increased.

A medical service is organised: it is conceived in the same way as a medical service in an industrial enterprise. As an enterprise its action is to be developed in the interests of the enterprise, as a medical service, its object is to ensure the good health of all human beings confided to it.

At the present time, the medical service has divided its activities into two main branches: individual and collective medicine.

Since 1945 the benefit of social insurance has been extended to families of serving and retired members. From the same date a social solidarity service has also been created.

It is expedient to point out that a nucleus of social service was formed under enemy occupation.

The legal system with regard to workmens' accidents and professional sickness is applied to the Company. This latter is its own insurer for workmen's accidents, and has organised its own medical service which confirms to the law.

b) *Société Nationale
des Chemins de fer Vicinaux.*

The legal regime is imperatively applicable to all employees who are engaged by a work-contract, i.e. practically the entire personnel. The remainder must benefit from advantages which are at least equal. To meet this purpose, an autonomous pension and health-service fund has been formed for these people.

Since 1945 a medical-social-service has been in operation for the entire personnel.

It takes care of:

on the medical side: health insurance of personnel, who are not subject to legal social security;

checking of absence due to sickness;

treatment of workmans' accidents;

sanitary protection for adolescents and employees exposed to professional diseases;

on the social side: help to agents and families.

The legal regime is applicable injured workmen, but the Company is its own insurer.

Compensation for professional sickness is taken care of by an Administration which is dependent on the State.

c) *Otraco.*

The legal regime is imperatively applicable to personnel. The medical service was formed in 1935, the social service in 1947.

The legislation on compensation for workmens' accidents, and professional sickness is applied integrally to Europeans; for coloured employees, very liberal regula-

tions, decreed in March 1948, are applicable retroactively from the 1-1-1947.

All these questions come under the jurisdiction of the Otraco medical service.

3. Denmark.

State Railways.

All these questions being governed by laws, there is no reason for employers to organise medical or social services. Employers have however, certain obligations.

In addition, the personnel have founded their own health-insurance fund.

4. Spain.

*Red Nacional
de los Ferrocarriles Españoles.*

The legal regime is compulsory. In addition, a social-assistance-service has been formed.

5. Finland.

State Railways.

The legal regime is imperative but it stops at defining main principles. It compels notably, the Railway companies to take steps for the maintenance and development of aptitude of personnel for higher paid jobs, and to organise medical and social assistance.

The medical service was formed in the last century and although it has since been developed, its structure has not been modified.

The social services were formed in 1946 (decree of 5th June).

The laws on compensation for workmens' accidents, and professional sickness are applicable to personnel. Cases are treated by a government office. Railway « accident stewards » carry out legal measures and inform the government office concerned.

6. France. — Algeria and Tunisia. Colonies and Protectorates

a) *The French National Railway Company.*

By virtue of a regulation published the 4-10-45 the French National Railway Company has the benefit of a special system of social service known as the « replacement system ».

However, the auxiliary personnel remain affiliated to the common right funds, except for family contributions which are paid by the Railway Company.

The Company must make contributions at least equal to those of the legal regime. The Company formed, long ago, medical and social services which have facilitated the organisation and adaptation of the company's special scheme to the general scheme.

A prudential fund assures the reimbursement of all or part of medical and sanitary expenses.

The Company accepts directly the extra expenses due to the operation, for its agents, of the pension fund, the different family allowances for all its personnel, the cover of risks for workmen's accidents and professional sickness for its permanent staff.

The role played by the medical services can be defined thus :

- examine candidates for physical aptitude;
- give assistance to sick and injured and check the results of those whom they can receive on other accounts;
- check periodically the efficiency of active agents (especially those engaged on security);
- organise assistance in case of accident (passengers and agents);
- following closely and provoke improvement of sanitary conditions and safety measures.

In the social field, the Railway companies have often been the first among the big professional organisations to undertake some very useful achievements (pension

fund, prudential fund, building of towns and schools, treasurer's offices).

Social assistance and social hygienic centres (preventive consultations) were formed more recently. Housekeeping courses have been organised and children can benefit from a healthy physical education thanks to open-air establishments.

Club halls are used to great advantage by sports, tourist, and amateur dramatic groups.

Apprenticeship and fitting of people for a trade, has been created, studied and brought up to scratch.

Personnel have themselves formed mutual-aid societies, the development of which has been followed and encouraged.

In 1938, the French National Railway Company, by superseding the Railway companies, first started co-ordinating and developing what existed by completing it and forming a coherent whole of the social services; it then extended their action wherever their intervention could be usefully active.

The legal regime of compensation for workmen's accidents and for professional sickness is applicable to the company's personnel although they get extra benefits (such as full pay during the entire period of temporary incapacity).

This system is applied by the different services in the framework of prescribed dispositions provided for to this effect.

b) *Régie autonome des Transports parisiens.*

The law allows certain private organisations to continue to function on condition that they assure benefits which are at least equivalent to those laid down by the law itself. The « régie autonome » is one of these organisations.

It has formed a medical and social service.

The first dates from the beginning of the operation of the Paris underground system, and since that time has not undergone any structural change.

All social institutions which had previously been working independently, were grouped together at the beginning of 1945 under one head-quarters. The personnel's representative organisation was named « Committee for the provisional management of social institutions ». Since 1947 these institutions have been taken over by the « Comité d'Entreprise du C. F. Métropolitain de Paris ».

The Administration is its own insurer for workmen's accidents and professional sickness, and is not subject to the legal regime.

A medical and a claims service work in close collaboration for the settlement of these questions.

c) *Algerian Railways.*

The legal regime is not applicable to personnel. The personnel has no pecuniary participation in the existing medical service.

The medical services were formed, from the beginning, on the sole initiative of the two big networks in existence at the time. They were re-organised in 1935 when the two networks were amalgamated.

In 1943, the Algerian Railways created a social service, which, owing to existing financial conditions, cannot be extended as desired.

The Railways are their own insurers for workmen's accidents. This service forms a part of the medical organisation.

d) *Gafsa Railways.*

The legal regime is not applicable. The Railway Company has attempted to arrange treatment for personnel on any part of the network.

The nucleus of a social service was formed in 1947.

The legal system of compensation for workmen's accidents and professional sickness is applicable to personnel and is included in the framework of the Algerian Railways medical service.

e) *Compagnie fermière des Chemins de fer tunisiens.*

Since its formation (1880-84) the company has assured a medical service for its personnel and their families.

The legal regime on workmen's accidents and professional sickness is applicable, but with certain extra advantages for permanent staff. The organisation is divided into the medical service (treatment) and the claims section (payment of compensation).

f) *French Equatorial Africa Railways.*

Agents benefit from medical treatment which is given in the network's hospitals and dispensaries.

g) *French West Africa Railways.*

Railway personnel are assimilated to the colony's functionaries.

Medical services, which are paid for by the Railway company are available at all Railway centres. Treatment has been free since the time the company was formed. Since then, this has been extended to workers' families.

Compensation for workmen's accidents and professional sickness is applicable under the legal regime, to the Railway company in the same way as it is to other industrial and commercial enterprises.

h) *Franco-Ethiopian Railway.*

Formed medical services from the time of founding — no structural modification since.

The system for workmen's accidents is incorporated under the laws governing the medical service.

i) *The Colonial Railways of Indo-China.*

There is no legal regime. Medical and social services have been formed by the company; the former, since its founding in 1903.

The medical service, which in the beginning comprised six sections, has been developed comparably with the network.

The legal system of compensation for workmens' accidents and professional sickness is applicable to personnel. The organisation of this service is done by the Personnel Management.

7. Greece.

a) *State Railways.*

The legal regime is compulsory.

The social security institutions which have been formed for the benefit of personnel comprise various separate organisations which together, form a complete social security.

These institutions comprise: the pensions fund (1926) mutual aid fund (1922) prudential fund (1931). The personnel play a part in the management of these organisations.

Compensation for workmen's accidents and professional sickness is made in accordance with the law.

b) *Chemin de fer Pirée-Athènes-Péloponèse.*

There are special funds, which were in existence before the laws, and which have remained autonomous.

Medical and pharmaceutical services have been formed under pressure from personnel.

For workmen's accidents and professional sickness, compensation provided for under the legal regime is applicable, when this is more advantageous than that which is granted by the special funds.

8. Hungary.

Hungarian State Railways.

The legal regime of social security is applicable, but this allows a certain licence as the law only lays down the framework.

The health insurance company compensates, on an autonomous basis, for treatment given to the sick. This system which was suspended from May to December 1944, was re-instituted after the liberation.

The Company is managed by a committee of 9 members.

A special service enforces the legal prescriptions in matters of workmen's accidents and professional sickness.

9. Italy.

State Railways.

The Railway company fulfils the functions of an insurance society for its statutory personnel. For others, who are much fewer in number, the legal regime is rigidly applied.

The Railway Administration, in conjunction with its central sanitary office, ensures the execution of all arrangements relative to hygiene and social medicine, as well as legal medical assistance, provided this results from a contract of transport.

The central sanitary office resulted from the fusion, in 1907, of less active organisations which had more limited powers, and which were founded by the private companies which managed the Italian Railways up to that date.

From 1907 to 1923, the technical sanitary activity progressively became autonomous from an administrative point of view.

The Railway Administration on their own insurers for matters of workmens' accidents and professional sickness. Legal prescriptions are applicable through the central sanitary office.

10. Luxemburg.

Luxemburg Railways.

The legal regime is applicable to auxiliaries and temporary workers, but there are certain latitudes.

For other personnel, the Railway Company has formed a mutual-aid medical fund, and an assistance fund for cases of hardship.

The mutual aid fund is run on similar lines to those of the legal fund.

All social questions are dealt with under social assistance.

The Luxemburg Railways would like to handle their own insurance for workmen's accidents, but this matter is still under discussion. In the meantime this service forms part of the Railways' social medical system.

11. Norway.

State Railways.

The legal regime is applicable to personnel who earn less than 9 000 crowns a year and whose membership with the Railway health insurance fund is compulsory.

Compensation for workmen's accidents and professional sickness is compulsory and is made according to the law. The Railways do their own insuring, and bear these costs alone. All cases are dealt with by the General Direction.

12. Netherlands and Colonies.

Netherlands Railways.

Any private system is accepted as long as its conditions are at least as favourable as the legal regime. It is represented by the mutual aid fund, which was in existence before the legal regime came into operation. This fund was created in 1870. In 1886, members families were also allowed to join. Since 1916, retired personnel with their dependants are affiliated. At the present time, statutory personnel earning less than 3 900 florins, and are compelled to join.

Compensation for workmen's accidents and professional sickness is paid by an independent organisation and according to the legal prescriptions.

13. Portugal and Colonies.

a) *The Portuguese Railway Company.*

The legal regime is rigidly applied. The same applies to compensation for workmen's accidents and professional sickness, which is taken care of by the Railway's social-medical service.

b) *State Railway (Mozambique).*

There is no legal system of social security.

Social medical services have been formed. The medical service deals with workmen's accidents and professional sickness; the legal prescriptions are applied.

14. Sweden.

State Railways.

The legal regime is applied by the social-medical service as far as workmen's accidents and professional sickness is concerned.

15. Switzerland.

a) *Federal Railways.*

A medical service was formed in 1916 at the Company's own initiative and without assistance from the personnel; at the latter's demand, real social services were formed.

In 1928 « psychotechnical » and « accident prevention » sections were inaugurated for the benefit of personnel.

The legal prescriptions are applied by the medical-social service in matters concerning workmen's accidents and professional sickness.

b) *Chemins de fer des Alpes bernoises (Bern-Loetschberg-Simplon).*

The legal regime is strictly applied.

The same applies to workmen's accidents and professional sickness.

c) *Emmenthal-Burgdorf-Thun Railway.*

The legal system is strictly applied.

16. Syria.

The Damascus Hama Railway and extension.

Strict application of the legal system.

17. Turkey.

Turkish State Railways and ports.

Strict application of social-security.

There is a medical service for which there is a compulsory contribution.

In the beginning, compensation was limited to first-aid and free medicine. Since 1927, members families also benefit from the scheme which has been greatly extended.

A legal regime, which is different for permanent personnel and temporary workers, and which is dependent on an organisation, which is entirely separate from the Railway Company, settles claims for workmens' accidents and professional sickness.

GROUP 3.

1. Which is the present organisation of your medical and social services (deal with medical and social services separately)?
2. Is there a separate department for each of the medical and social branches? Or else do the latter from a common department independent of the other departments? Or else are these services connected with another department? If so, which one (if possible, join an organisation diagram)?
3. Which is your specialized staff (physicians, surgeons, nurses, female welfare-workers, etc.)?
4. How does the recruitment take place? Is the staff composed of statutory, non-statutory or temporary employees?
5. Do they work full time or part time?
6. Is this staff being paid by your Administration or by a special fund (social welfare fund)?

REPLIES.

1. Austria.

Austrian Federal Railways.

The medical service is run by the chief of the sanitary service, who is responsible to the Managing Director. In addition

there is a head doctor in each of the four headquarters, and there are 124 doctors (1 per district). The head of the department and the chief doctors are Railway functionnaries. The other doctors are employees with functionary status. They are paid by the Railway Administration.

2. Belgium and Colony.

a) *The Belgian National Railway Company.*

Medical services:

Principles: 1) personnel and members of their families who are sick have the free right to choose their own doctor. The latter eventually fixes the period of absence from work;

2) personnel who are injured during the course of duty, or who contract an illness caused by their particular job, are compulsorily treated by the company's organised services.

Organisation: 2 main medical services = individual and collective, dependent on medical service headquarters to which are attached among other things, a technical secretary's office and a psychotechnical laboratory. This is headed by a doctor in chief, deputy to the director of personnel and social services.

Collective medical service comprises the following departments, each headed by a doctor, assisted by one or more deputies:

- works medical inspection (hygiene and cleanliness of buildings, and Railway installations in general, prevention of accidents and diseases, improvement of working conditions);
- preventive medical service (recruiting examinations, supervision of adolescents, tracking down of professional diseases, periodical examination of personnel and families);
- medical supervision and care for backward children in homes, supervision of apprentices (physical training), medical advice to practise sports;
- survey of places of treatment.

Individual medicine, which is also controlled by a doctor in chief, comprises the regional centres (12 for the network) and the following departments which are headed by a principal doctor:

- an appraisalment committee for workmen's accidents;
- an appraisalment committee for professional aptitude;
- a central X-Ray service;
- a central service of special supervision (syphilis, tuberculosis, diabetes, Basedow's disease, mental disorders, etc.);
- general medical inspection service.

In each of the regional centres there are, apart from the chief doctor, 3 or 4 assistant doctors, and reliable specialists. There is a good X-Ray installation and a laboratory for normal analysis in each regional centre.

Welfare work comprises social insurance and social solidarity, the whole managed by a National Committee.

The medical and social services are attached to the management of staff and social services.

The specialised personnel comprises doctors (general medicine and traumatology), nurses, male and female social assistants, and psychotechnicians (male and female).

Confidential specialists assist the staff doctors for cases within their particular spheres.

All the staff is recruited by competition; the successful ones are called upon to serve as statutory agents and hence work full time. Their pay is for account of the Administration.

b) *Société Nationale
des Chemins de fer Vicinaux.*

The medical service comprises 1 head doctor and 1 assistant, as well as a certain number of part-time doctors.

The social service comprises 2 social monitors and 8 social assistants.

The head doctor is a whole-time official; the regional doctors have no ties with the company and are remunerated as supernumeraries.

The social service staff comes under the normal roll of the company.

All this personnel functions at the company's expense.

c) *Otraco.*

There is a medical management and a management for native labour; both of them are under the general management.

The social service for natives is attached to the medical direction. A similar service for the European staff exists at Brussels.

The staff comprises:

Europeans: 6 doctors, 11 sanitary workers, 2 hospital nurses and a certain number of appointed doctors.

Natives: 3 auxiliary doctors, 21 nurses, 91 assistant nurses, 7 assistant midwives and 7 sick-nurses (*all certificated persons*), 10 full time and 3 half time social assistants + 1 apprentice.

The medical personnel is engaged by contract, not by law.

Remuneration is for the account of the Administration.

3. Denmark.

State Railways.

No reply.

4. Spain.

*Red Nacional
de los Ferrocarriles Españoles.*

The central sanitary service, composed of a medical direction and a technical secretariat, is subdivided into 1 clinical section and 1 health section, each managed by 4 doctors (1 chief of section, 1 sub-chief, 2 inspectors).

Duties of the *clinical section*: help to injured staff in the course of their duties, and to injured passengers, recruitment visits, periodical examination of certain categories of agents.

Health section comprises 4 sub-sections: disinfection and freeing from vermin, epi-

demology, hygiene and working-security, sanitary statistics.

The Railway network is divided into 7 zones, each directed by a chief, 1 sub-chief and 2 inspectors (all doctors). Each zone has an emergency dispensary and a traumatology sanatorium.

The zones are subdivided into primary units under the care of a doctor who gives the first orders in case of accidents, supervises the sanitary means and controls sick agents. Sanitary panels are provided at places grouping at least 300 workers. An incumbent doctor assisted by male-nurses or assistants is attached to each panel.

Railwaymen's centres exist, a doctor residing in each.

A central analytical laboratory comprises 3 sections, each managed by a technician.

Medico-social services, managed by 1 chief doctor and 1 assistant doctor, are attached to the staff management.

In addition to doctors for all specialities there are male nurses or assistants and visiting female nurses attached to the social assistance services.

There are two classes of doctors some comparable to officials and others bound by contracts.

The visiting female nurses are statutory agents. The statutory staff is full time.

5. Finland.

State Railways.

Medical service: a central department constituted by the sanitary section, under the authority of a chief doctor. Managed by the « Economic-Financial » service. In certain localities and at important stations there are polyclinics managed by Railway doctors.

Social service: a central department consisting of the welfare section forming part of the same « Economic-Finance » service; at its head a social welfare chief. This service comprises 4 districts.

The medical service comprises 1 head doctor assisted by ordinary and extra-

ordinary Railway doctors, doctors for Railway constructional works, one accountant, 1 sanitary inspector, 1 hospital sister, 1 disinfectant and certificated nurses.

The *social service* comprises 1 chief for welfare and 1 assistant, 1 trainer for sports. In addition, 1 chief for each of the 4 districts and 1 welfare chief on work sites.

The personnel is recruited on a system of requests. It is employed on full time, except for the line-doctors. The latter are paid annually by the government according to the extent of the lines and the number of patients.

6. France. — Algeria and Tunisia Colonies and Protectorates.

a) French National Railways.

The central division of the social and medical service is entrusted with and controls the medico-social services within the personnel central service of the general management.

It draws up the general lines and rules to be followed. It organizes and facilitates the applying of the means to be used. The district services assume the responsibility and execution with the aid of local qualified organisms.

These medical services, independent of the technical and local services, are attached to the management of each of the regions.

The management and control of the working of the various local activities, drawn up for the benefit of the agents, former agents and families are undertaken by a central committee for social activities, presided by the director of the personnel central service.

The regional committees are presided by the director of each region. They follow the instructions of the central committee and examine suggestions and proposals made by the local services or organisations.

Local committees, formed by the mixed establishment committees, supervise, attend to and control the working of the various local social activities.

These various committees are formed by representatives of the S. N. C. F. and staff.

The medical service of each region of the S. N. C. F. is directed by a chief doctor assisted by 1 or 2 principal doctors. It, in turn, is under the orders of the chief engineer attached to the regional management, whose authority extends to the whole social and medical services of the region.

The chief doctor has at his disposal establishment-doctors and sectional doctors, as well as specialists.

The establishment and sectional doctors give consultations and general medical treatment to all the agents. They are spread over the whole railway system in the principal centres.

Specialists are attached to the regional management or to a few important centres.

An appeal can be made to the chief medical officer on any rulings given by establishment or sectional doctors.

The welfare services of the S. N. C. F. are entrusted with creating co-ordinating and furthering all activities of a social nature apt to facilitate conditions of living and improve the bearing of agents and their offspring.

These activities have been divided into 4 categories:

- those at the disposal of workers in the exercise of their profession;
- those that apply both to workers and their families;
- those that only concern home-life of workers;
- those arising from the existence of the various groups and societies formed by the workers.

The specialised personnel comprises doctors, some full time, others tending the personnel as their own clients. In the large centres doctors have at their disposal personnel holding diplomas: nurses, laboratory workers, etc.

The specialised personnel of the social services comprises female welfare workers, secretaries, male and female directors of reception centres, rest houses, cure-homes and holiday places; nurses, children's atten-

dants; kindergartens; a teacher and female monitors to instill housekeeping; advisors guiding the young into various professions; male and female monitors for educating youth, documentary specialists, librarians, etc.

The whole of the paramedical personnel is recruited by selection from candidates holding a State diploma (nurses) or a diploma issued under the control of the latter. This personnel may, under certain conditions, be admitted to the permanent staff.

The personnel of the social services is recruited by selection. A State diploma is required, or else suitable training for the branch chosen. Part of this personnel is admitted to the permanent staff or assistant staff. The remainder are employed as helpers and temporarily.

A certain number of doctors works full time. Others only devote to the S. N. C. F. part of their time, in the form of holidays; others again give their services as to private patients.

The paramedical personnel of the permanent staff works full time. Only a few members of the auxiliary staff are part time.

Social aids, professional advisors, kindergartens and staff working under the management of social establishments are full time.

Other members of the social personnel are part time in certain cases.

All this personnel is remunerated direct by the S. N. C. F., which pays expenses within the annual budget of the medical and social services.

The providend fund of the S. N. C. F., which is financially autonomous and which acts, for everything arising from the sanitary realm, as a social security fund for the personnel in general, undertakes the cost of all these personnel outlays.

b) *Régie autonome des Transports parisiens.*

The medical service attached to the staff management has two subdivisions:

1) technical medical — treatment and prevention;

2) administrative medical — administers and controls.

The *social service* is also attached to the staff management.

There are general practitioners and specialists, male and female nurses, laboratory workers, assistant doctors, chemists, surgical bandage-makers, social assistants.

Doctors and dentists are paid professionally and are recruited on the advice of the chief doctor to the director general.

Male and female nurses, laboratory workers and welfare helpers form part of the personnel and are recruited according to their titles. They work full time.

The pay of all this staff is for account of the Administration.

c) *Algerian Railways.*

Medical service: the system is divided into 119 medical sections spread over 3 regions — 1 chief doctor responsible only to the director.

Social services: only comprise one single administrative bureau attached to the management.

In addition to sectional doctors, the staff comprises specialists, male and female nurses.

Doctors and nurses recruited by title do not come under statutes.

Nursing sisters who combine the twofold condition of age (under 29 years) and competency (State diploma) can be admitted to the permanent staff. Otherwise they form part of the auxiliary staff, but come under the direct orders of the health service of the general government.

Doctors are employed on part time and the others on full time.

All this personnel is paid directly by the Railway.

d) *Gafsa Railway.*

Each doctor has his own zone. In 2 principal centres they are daily and at fixed hours at the disposal of workers and

their families. They travel to small stations if called.

The service controls the staff on engagement.

The social service attends to both French and Moslem families. It organises holiday-centres in Europe and courses of study.

In addition to the doctors there are male nurses and 1 social female assistant.

The doctors are engaged by contract and part time. The remainder of the personnel is statutory or temporary and works full time. All are paid by the Administration.

e) *Compagnie fermière des Chemins de fer tunisiens.*

The *medical service* is under the orders of a chief doctor who, in turn, is dependent on the company.

There are administrative districts which are each entrusted to a doctor. In addition, there are specialists.

Social services: no particular organization. All functions come directly under the management.

As specialised personnel, there are male nurses, chiefs of camps and monitors of holiday-colonies and planners.

Doctors are not agents of the company, nor canteen staffs.

The others are statutory or auxiliary agents.

The male nurses and canteen staffs work full time; likewise the camp-chiefs and monitors for 3 months of the year.

Nearly all this personnel is paid by the company.

f) *French Equatorial African Railways.*

The Railway system has dispensaries that are managed by a doctor belonging to the Administration.

g) *French West African Colonial Railways.*

The organization is run on the lines of the local health service and comprises 1 chief of medical services at the headquarters of each regional management and sectors managed by 1 sectional chief doctor.

The specialised personnel comprises:
 4 European doctors, 5 African;
 3 European male nurses + a certain
 number of Africans;
 1 nursing-sister and 1 midwife.

h) *French-Ethiopian Railway.*

One head doctor is under the direct authority of the operating management.

There is a medical centre at Diré-Daoua (1 surgeon, 1 chemist, 7 male nurses, 1 female social assistant, 1 accountant) comprising 1 hospital and a maternity. In addition, there is a dispensary at Addis-Abeba and another at Djibouti.

There is no social service.

The doctors are recruited in France: 3 are statutory, 1 non-statutory, plus a female welfare worker and an assistant chemist. The non-statutory doctor is the only to work part time.

All this personnel is paid by the company.

i) *Indo-China Colonial Railway.*

The medical service is directed by a chief doctor and is attached to the staff service.

The Railway system is divided into 12 medical sections, each managed by a sectional doctor. The doctors are assisted by male and female nurses.

In the important centres there is an infirmary.

The social service is independent of the medical service.

The medical personnel is usually detached from the Indo-China medical assistance corps. At certain isolated places a military doctor performs these duties.

The service functions as full time and the cost is for account of the Railway.

j) *Moroccan Railways.*

The medical service is carried out by appointed doctors and male nurses.

Recourse is had to colonial hospitalising establishments.

The social services have created holiday and summer centres.

Sports clubs are subsidised.

There are a certain number of welfare workers.

The organisation, which is very simple, has only recently begun.

7. Greece.

a) *State Railways.*

The medical service, under the direct orders of the general management, is directed by a chief doctor aided by 2 assistants and an inspectional doctor. There are doctors at centres; sectional doctors travel on fixed days to given places; there are also visiting doctors.

The Railway system is divided into 16 medical districts, 3 of which have a dispensary fitted out in a quite modern style. To each of these dispensaries there is attached a corps of doctors, consultants and specialists.

At large Railway centres there are chemist's shops, the property of the fund; elsewhere there are appointed chemist's shops.

The medical personnel and nursing sisters are recruited by selection and do an apprenticeship like other agents. Only the service-chief, the heads of dispensaries and the nurses are full time; the others are part-time.

b) *Piraeus-Athens-Peloponnesus Railway.*

No separate social service.

The medical service is under the orders of the general management. It comprises: 1 chief doctor, approved doctors, specialists and a few nursing sisters.

A few doctors are statutory, the others temporary.

Only the chief doctors works full time.

Pay is for account of the Railway, except that of a few units which is for account of the mutual assistance fund.

8. Hungary.

Hungarian State Railways.

A central chief doctor directs a twofold

service: the Railway medical service and the social security medical service. Each of them, directed in turn by an administrative chief doctor, is divided into smaller regions or districts.

The sundry medico-social branches have no particular management but are comprised in the various Railway organs.

The medical and social personnel is partly statutory and partly temporary. Part of it functions full time and part of it part time. 80 % of the pay for the medical staff is paid by the Railway and 20 % out of the sick-benefits fund. The latter pays the whole of the social service staff.

9. Italy.

State Railways.

Sanitary services are carried out by official doctors and confidential doctors. The former are attached to the central sanitary office and to the 18 sanitary inspections (in all: 90 official doctors, 1 official chemist, 45 consultants and 72 specialists).

The confidential doctors (bound by contract) are attached to 1619 medical districts.

All medical specialities are represented at the central office.

In each of the 18 inspections there are 2 consultants and 4 specialists.

The central office also possesses a radiological cabinet, a laboratory for psychotechnic work, one chemistry and one bacteriological laboratory, a school for male nurses and disinfectors, a library.

In 1950 all the inspections will have radiological and psychotechnical cabinets.

The organisation is not divided into medical and social services.

This organisation forms a technical complex within the staff and general affairs service.

The specialised personnel comprises doctors, male nurses and disinfectors. It is recruited by public competition. The statutory personnel works full time; the

confidential staff part time. Pay is for account of the Railway.

10. Luxemburg.

Luxemburg Railways.

Medical service comprises: control of and help for sick or injured staff; preventive and administrative medicine.

There are 5 confidential doctors; their pay runs in accordance with a pre-arranged tariff. One of the doctors attends to certifying men for enrolment and periodical examinations of security personnel. Two others are members of the retirement commission.

There is a hygiene committee and nursing staff for first aid.

The medical service combats social diseases in co-operation with public health institutions.

The social service deals with administrative affairs concerning the medical and social division: keeps a watch over sick persons, with a view to their again taking up work that is suitable to their physical aptitude, helps to draw up the social and medical budget, keeps an eye on expenses, applies the laws regarding social insurance and deals with the prevention of accidents.

The medical and social branches combined form the medical and social affairs service of the Railway.

In addition to the doctors there is a female social assistant. She is a full time statutory agent, whereas the former are paid according to their attendance and are used part-time. All are paid by the Railway.

11. Norway.

State Railways.

In addition to the sickness fund there is a helping fund for widows and orphans.

Medico-social matters are dealt with by the general management.

12. Netherlands and Colonies.

Netherlands Railways.

The applying of the legal dispositions is the task of the general service, comprising :

- social relief;
- sick relief fund and pension fund;
- control over sick agents, medical examinations management of the recognized medical service;
- education, teaching.

Each branch has its own management.

The official medical service functions in 5 central workshops which have a first aid post. First aid is given by persons holding diplomas. A doctor gives consultations for the treatment of injured persons.

This official medical service is under the independent management of a doctor. It includes several persons holding diplomas for the bandaging of injured workers and welfare assistants for the female staff.

The relief fund has engaged a consulting doctor, a consulting dentist and a consulting chemist; the latter are non-statutory.

The other persons holding diplomas are recruited from the staff and are regarded as statutory agents.

Social assistants are also statutory; they are full time.

The personnel of the official medical service and the welfare assistants are paid by the Administration, consulting persons by the relief fund.

13. Portugal and Colonies.

a) *Portuguese Railway Company.*

The medical services are directed by a chief of department, assisted by a sub-chief and other doctors. They are subordinate to the general management.

Doctors are assisted by male nurses. Recruited by competition, they form part of the statutory personnel; the former work part time and the latter full time. All are paid by the Administration.

b) *State Railways (Mozambique).*

The medical personnel comprises: 1 chief doctor, line-doctors, male and female nurses. The staff is paid by the Administration.

14. Sweden.

State Railways.

There is no special organisation of medico-social services.

All business is transacted, according to its nature, by the various sections of the management.

Doctors are recruited according to requirements; nursing sisters belong to the statutory personnel. The latter are full time, the former part time. All are paid by the management.

15. Switzerland.

a) *Federal Railways.*

Medical service : the medical division comprises 20 agents 5 of whom are doctors, subject to the general management, department of finance and personnel.

Social service (37 agents) : comes under the same department.

The two services each form an autonomous division of the general management.

A head doctor and 4 others are engaged permanently. In addition, 37 doctors are engaged accessorially. There are no social assistants.

All this personnel is engaged permanently and works full time, with the exception of the 37 appointed doctors who work to suit their practice. Remuneration is for account of the Railway.

b) *Bernese Alps Railways (Bern-Lötschberg-Simplon).*

The various funds are managed by a committee under the control of the management; members are appointed by the management and the associates.

c) *Emmental-Burgdorf-Thun Railway.*

Accident-insurance is covered with the Swiss Accident Insurance Company of Lausanne. There is a Railway fund for pensions. This fund is managed by a committee on a parity basis.

There is no specialised personnel.

16. Syria.

Damascus, Hama and extension Railway.

The medical service comprises 1 head doctor and 6 appointed doctors (1 per centre). In addition, there are 4 specialists O. R. L. paid according to services rendered.

Administratively, the medical service is under the orders of the Railway board and technically under the head doctor.

The personnel only comprises doctors, all non-statutory; they are employed full time at the large centres, part time at others. Remuneration is for account of the management.

17. Turkey.

Turkish State Railways and Ports.

The medical service is under the orders of a director attached to the general management.

There is a medical inspection in addition to each managerial Administration and to the general management.

In addition to medical specialists working in hospitals, there are 94 doctors, 14 surgeon-dentists, 17 chemists, 15 sanitary workers, 5 midwives, 34 assistant chemists, 30 nursing staff, 8 vapour-bath mechanics, 73 servants.

All this staff is statutory, recruited according to diplomas held and full time (except the hospital specialists). Their pay is for account of the management.

GROUP 4.

Medical.

1. *What facilities are provided for Railway staff to obtain medical assistance?*
2. *How many Railway hospitals are provided on your Railway system, stating the total mileage and staff employed?*
3. *Do Railway hospitals deal with first aid only or do they attend to all outpatient and inpatient cases?*
4. *How many hospitals per 100 000 railwaymen are provided?*
5. *How many inpatient beds are provided per 1 000 men?*
6. *What is the standard of equipment provided in the hospitals?*
7. *Is there a surgical section attached to all hospitals?*
8. *Are special clinics provided to treat chronic cases e.g. tuberculosis?*
9. *Is admission to inpatient and outpatient wards restricted to Railway employees only or is it also open to their families including dependent members?*
10. *How are Railway staff at wayside stations and away from important towns given medical assistance?*
11. *Do you have Railway doctors travelling in certain fixed days of the week over the different sections of the Railway in order to give medical and pharmaceutical assistance?*
12. *Do you have mobile dispensaries serving wayside stations?*
13. *Do Railway doctors charge any normal or even reduced fee from the employees or is the attendance free?*
14. *Do Railway doctors charge any fee when called upon to treat dependent members of the staff?*
15. *What is the relief granted to your diseased agents in respect of indemnification for illness unemployment, duration of the protection previous to the pensioning off, re-employment of the semi-fit employees?*
16. *What is the relief granted to your agents wounded in service or suffering from professional diseases, in respect of indemnification for the periods of absence, duration of the protection previous to the pensioning off, re-*

- employment of the semi-fit agents, indemnification of agents suffering from a permanent (partial or total) work-disablement?
17. What is the relief granted to family members of railwaymen on active service, to pensioned agents and members of their family, in the matter of sickness-insurances?
 18. What is the usual scale of medical services given to railwaymen on your system?
 19. Are any sanitoriums provided for railwaymen to recuperate during convalescence?
 20. Are free travel facilities given to (a) railwaymen, (b) dependent members of staff when attending hospitals for treatment?
 21. Are medicines (including patent ones) given free of cost?
 22. Are Railway staff reimbursed with the cost of medical attendance when treatment is considered necessary by a specialist?
 23. Do Railway hospitals function directly under the control of the Railway or is there a separate board of control and if so what is the constitution of the board?
 24. In view of the fact that majority of the Railways are under State control, do the Railway hospitals come under the supervision of the department of public health? If so, what are the rules and regulations for the maintenance of hospitals?
 25. How are your medical services administered? Unilaterally or with the participation of the staff? In the latter case, on a equal basis or with a reduced representation of the staff? Give us full particulars about the conditions of such a co-administration. How are the staff delegates chosen if there are any (free election, nomination by all staff-organisations, or only by some of them; in that case, what conditions are those associations to fulfill)?
 26. Do the pensioners participate in the administration of medical welfare?
 26. How is the budget of those medical services drawn up? How is this budget allocation financed? What proportion is contributed by the Administration and staff (both active and retired employees) separately.
By whom and how are the financial operations being done?
 27. Are opportunities provided for staff to examine general arrangements given in hospitals and to give suggestions for improvements?
 28. Is the staff allowed free choice of the doctor, the chemist and on occasion, the nursing institution?
 29. Is the female staff allowed a maternity and breast-feeding leave? Continuously, what is the amount of the confinement, new born baby clothing and breast-feeding indemnities?
In this respect, how are the wives of employees or pensioners dealt with?
 30. Is there a decease indemnity for the employees and for the pensioners?
 31. Does your medical service contribute towards the cost of prosthesis equipment and particularly of bandages, teeth, spectacles, ear-apparatus?
In such cases, what do you provide to the victims of work accidents whose infirmities require the use of apparatus?
 32. Do you consider as work accidents, those occurring on the way to the working point?
 33. Does your Administration dispose of ambulances for the transport of the ill and wounded?
Do the employees contribute towards the cost of such transport?

REPLIES.

1. Austria.

1st Sub-group (Questions from 1 to 14).

Federal Austrian Railways.

(± 6 000 km — 87 000 railwaymen.)

Sick railwaymen apply to the railway-

doctor of their district. They are entitled to gratuitous consultations of specialists.

The members of the family railwaymen on active service, or pensioned men benefit by the same advantages.

The Administration has no ambulance-cars.

2. Belgium and Colony.

a) *Belgian National Railways Company.*

(\pm 5 000 km — 92 000 railwaymen.)

The sick railwaymen have free choice of the doctor, chemist and attendance institution. The injured men on service must have obligatory recourse to the attendance organised by the Railways, which have no hospitals nor clinics, but the construction thereof is contemplated.

The company does not possess special institutions for attendance of chronic diseases, but agreements have been concluded with private approved institutions. The railwaymen and encumbrances attended in hospitals do not obtain extra travelling commodities, except in some special social cases.

The Railway Company has one ambulance-car. The transport of injured men on service is gratuitous; sick railwaymen are transported at cost price and for their own account.

b) *Société Nationale*

des Chemins de fer vicinaux.

(\pm 5 000 km — 12 250 employees.)

The employees have free choice of the doctor, chemist and attendance institutions; all those submitted to the legal regulations of the social security, as well as those who are not ruled by such regulations, but are obligatory affiliated in the health-insurance service (of the S. A. M.) benefit by the same advantages. No hospital belongs to the company, which has no ambulance-cars.

c) *Otraco.*

595 km; native railwaymen: 11.340

(6 500 women and 12 500 children); European staff: 318 (240 women; 227 children).

The medical attendance is supplied in dispensaries or hospitals in all the places where there is an agent of the medical service.

The importance of material and means is in relation to the professional qualifications of the agent of the medical service and the importance of the population to be attended.

The European railwaymen in Léopoldville have free choice of the doctors.

The Administration possesses 3 hospitals for the natives (with 230 beds) and 1 hospital formation for Europeans (with 15 beds). Such hospitals supply complete attendance to boarded or travelling patients.

They are equipped normally and always possess a surgical section. European railwaymen suffering from chronic diseases, e.g. tuberculosis must be repatriated. As far as the native railwaymen are concerned, those suffering from tuberculosis, leprosy, trypanosomiasis, are forcedly segregated in isolation hospitals.

The encumbrance benefits by hospital attendance like railwaymen. Such hospitals are directly under the control of the medical direction. They are not submitted to the control of the medical service of the Colonial Government, to which however reports are regularly sent.

The staff does not intervene in the working of the hospitals and has no suggestions to make thereabout. Travelling facilities are allowed to the railwaymen and their encumbrance, who must be attended in the hospitals of the Administration.

Ambulance-cars are put, free of charge, at the disposal of sick employees.

3. Denmark.

State Railways.

(\pm 2 400 km — 28 000 railwaymen.)

The health-insurance fund created by the staff supplies free of charge medical attendance and allows notable reductions

for hospital attendance and medicines.
The Railways do not possess hospitals.

4. Spain.

*Red Nacional
de los Ferrocarriles Españoles.*

(\pm 12 800 km — 130 000 railwaymen.)

There are sanitary colonies.

150 rooms are reserved in the State sanatoriums for the railwaymen and the members of their family.

The encumbrance benefits by the same hospital attendance as the staff.

5. Finland.

State Railways.

(\pm 4 700 km — 37 800 railwaymen.)

The sick railwayman applies to the Railway doctor or to the dispensary of the polyclinic.

The Railways possess one hospital with 25 beds and 4 infirmaries. Only light cases as well as patients in observation are attended there.

Attendance to complicated cases is supplied in State hospitals of districts and municipalities, and in some urgent cases, in private hospitals.

The Railway hospital of Helsinki is modernly equipped for the attendance of internal sick and possesses one radiology installation, but no surgical section. Infirmaries have limited means. Such services are under the control of the chief doctor.

The medical service itself is under the control of the State health department.

There are no special Railway institutions for chronic patients.

The staff alone may benefit by hospital attendance. It does not intervene in the working of the hospital services.

The staff members destined for being attended in a hospital benefit by traveling facilities.

The Administration has no ambulance-cars.

6. France. — Algeria and Tunisia, Colonies and Protectorates.

a) *French National Railways (S. N. C. F.).*
(\pm 40 000 km — 465 000 railwaymen.)

The sick railwayman has at his disposal the section or institution doctors (when he can travel), or the sector doctor (when he is unable to travel).

The medical attendance is free. If doctors agree thereto, the patient may eventually consult a specialist-doctor. In urgent acknowledged cases he may have recourse to such specialist directly.

Special attendance is supplied on prescriptions given by the doctor of the medical service of the S. N. C. F., either in the residence of the patient by the paramedical staff of the S. N. C. F. or elsewhere. If the railwayman has recourse to auxiliary private doctors, his expenses are refunded at the rate of the official tariffs.

The hospital attendance expenses are borne wholly by the fund when the hospital or the clinic has concluded a special agreement with the latter. In the other cases, the refund on the basis of agreements with similar institutions.

The S. N. C. F. does not possess a general hospital. The provident fund has just undertaken the Administration of a hospital center in the Parisian suburbs, and it intends to constitute there an important institution for medical attendance, for travelling and boarded patients. That hospital will have 600-700 beds, 40 % of which will be reserved for the railwaymen of the S. N. C. F. It will be equipped to meet all requirements. It already has an important surgical section.

The S. N. C. F. possesses many institutions for attending tuberculous patients:

in Séricourt : 110 places for railwaymen and adult sons of railwaymen;

in Villevaudé : 45 places for the post-cure; it is a dependance of the first named hospital;

in Passy: 130 places for railwaymen's children, boys till 14 years of age and girls till 18 years of age.

The S. N. C. F. has hired and transformed a small castle in St Hilaire du Touvet as a sanatorium, reserved for adolescent boys.

The health-insurance fund of Alsace-Lorraine possesses one sanatorium with 115 beds in Munster.

There exists one preventorium for children in Entveig (Pyrénées Orientales).

One mutualist association, the « Sanatorium des Cheminots » created for the railwaymen and their families, 3 sanatoriums for adults (one in Ris-Orangis and two in Champrosay).

Another association, the preventorium for railwaymen's children had created one marine preventorium in Asnelles-sur-Mer, but it was destroyed during the allied landing operations in 1944. It is replaced provisionally by the preventorium of Chevières, which can receive 250 children.

The family members benefit by hospital attendance (boarded and travelling patients) like the railwaymen. They are not admitted in the dispensaries and centers of the medical services of the S. N. C. F., only reserved to the railwaymen. They are admitted however in the social medical centers and social health centers of the S. N. C. F.

The sanatoriums are administered by the medical services of the S. N. C. F., depending on the regional directions. The hospital center is under the authority and control of the board of the provident fund.

All the hospital institutions of every description are submitted to the control of the public health services. Such control leaves to the Railway institutions full initiative and liability, as it may be desirable.

The staff can make all useful suggestions concerning the good working of the attendance institutions of the S. N. C. F.

No special travelling facilities are allowed for attendance in hospitals.

The Railway company has some ambulance-cars at its disposal. Transport is free. The provident fund refunds the whole or a part of the transport expenses occasioned by other ambulance-cars, required by the patients.

b) *Régie autonome
des Transports parisiens.*

They have at their disposal 15 dispensaries in the Paris region. The medical service there gives free consultations and current attendance. Among such dispensaries there are 3 polyclinic centers and 5 centers with dentist's cabinets.

One group of approved doctors attend in their residence on laying-up patients.

Surgical operations are performed in 2 clinics with which the Administration has an agreement — the expenses being for account of the Administration — 35 beds are reserved there. Such operations are done by 2 chief surgeons approved by the Administration.

The Administration does not possess hospitals. Public hospitals receive patients for account of the Administration and at the tariffs of the social security system.

Personnel with chronic illnesses are sent to public or private institutions in France.

The families of the railwaymen do not benefit by a stay in the agreed clinics.

The railwaymen and their families benefit by the normal travelling facilities.

The Administration does not possess ambulance-cars and uses the municipal ambulance-cars. The transport expenses are refunded to the railwaymen.

c) *Algerian Railways.*
(± 4 300 km — 18 700 railwaymen,
with 40 000 persons as encumbrance.)

The Railway doctors receive in their cabinet patients and injured of the permanent staff and their family encumbrance, as well as the retired men, with exclusion of their family, permanent auxiliaries on service since at least 3 months. They visit at home, in the town or on the Railway line, the railwaymen on service and the

members of their family who cannot travel. They visit at home too the auxiliaries injured on service.

They draw up certificates and reports for each working accident, attend with urgency travellers injured in the periphery of the Railways — go on the spot in case of Railway accidents; they make visits for enlistment of railwaymen, fix the percentage of working incapacity, for revision purposes; they do all administrative formalities or control formalities caused by the various situations in which the railwaymen could be found.

The Railways do not possess hospitals. The railwaymen and their families are attended to in the many hospitals belonging to the service of health of the government.

They possess no special institutions for chronic patients, e.g. the tuberculous.

The railwaymen fulfilling some statutory conditions are entitled to free attendance at hospitals. The expenses thereof are advanced to the other railwaymen and their family members by the Railways, which then recovers the sums advanced by means of monthly deductions from the salary.

The medical attendance to travelling patients are free, as well as the railwaymen's encumbrance.

There are no special commodities allowed for a stay in hospitals, the commodities allowed to the railwaymen and their family members being sufficient.

The Railways do not possess ambulance-cars, but refund the expenses for transports of that kind.

d) *Gafsa Railways.*

Simple medical attendance and even small surgical interventions are given in the 2 centers. In other localities the staff must go to the doctor or send for him in grave cases.

The Railways do not possess hospitals but benefit by the mine hospital of the same company. All interventions can be done there.

There are no special institutions for chronic diseases, e.g. tuberculosis.

The railwaymen's families are admitted to the dispensaries.

No special travelling facilities are granted.

e) *Compagnie fermière
des Chemins de fer tunisiens.*
(± 1 656 km — 5 900 railwaymen.)

The company has opened dispensaries, the most important of which has at its disposal consulting cabinets for many important specialities and one radiographic service.

The railwaymen go to the doctor's cabinet.

The company does not possess hospitals and institutions for attending all patients suffering from chronic diseases.

The encumbrance persons are entitled to gratuitous consultations in the dispensary or the consultation cabinets of doctors.

No extra travelling facilities are allowed for going to hospitals.

The company does not possess ambulance-cars. The patients pay their eventual transport by a conveyance of that kind. The transport of injured men on service is gratuitous.

f) *French Equatorial-Africa Railways.*
(1 014 km.)

Two dispensaries give daily attendance not requiring the presence of a doctor. The staff has furthermore at its disposal the medical service, hospitals and dispensaries of the Colony.

g) *Colonial French West-Africa Railways.*

There is a medical service in each regional direction, including the chief doctors of each sector, the service of the Dakar-Niger region and the services of the public health.

The family members benefit by the same advantages as the railwaymen: medical attendance and medicines supplied gratis (with exclusion of specialities) and hos-

pital attendance provided; a small deduction from the salary is made.

The railwaymen and their encumbrance have at their disposal all travelling facilities for going to a hospital.

The Railways have at their disposal one ambulance-car.

- h) *Franco-Ethiopian Railway.*
(784 km — 409 Europeans
and 4 470 natives.)

The Railway possesses one hospital in Diré-Daoua and 3 infirmaries. The hospital has 40 beds and attends all patients. There are distinct pavilions for the various classes of diseases, one room for surgical operations, one radiology installation and one laboratory.

The Railway has no special institutions for attending chronic diseases.

The families benefit by the same advantages as the railwaymen.

The hospital and infirmaries are under the control of the Railway.

On the French Somali coast, the company uses the State hospital.

In Ethiopia, there is a simple control of the exercise of the medical science and hygiene.

The staff delegates may present requests and suggestions in the interest of the service.

The transport to the hospital is free.

The Railway does not possess ambulance-cars.

- i) *Colonial Indo-Chinese Railways.*
(1 484 km — 6 618 railwaymen.)

The Administration has at its disposal all the means necessary for current attendance, but does not possess hospitals.

Patients suffering from chronic diseases (leprosy, tuberculosis, etc.), are sent to the State hospitals.

The families benefit by free medical attendance by the hospital; boarding is for their account.

In the future, the staff may make suggestions in order to improve the service.

Travelling facilities are granted.

The company does not possess ambulance-cars, but has recourse to those of the State hospitals, as the need may be. The expenses therefore are for its account.

- j) *Morocco Railways.*
(1 091 km.)

They have at their disposal appointed doctors and nurses and have recourse to the Protectorate hospitals.

7. Greece.

- a) *State Railways.*
(± 1 050 km — 6 000 railwaymen.)

There are 16 regional centers, 3 of which possess a dispensary.

Doctors are found in the principal centers along the railway lines; other doctors travel on determined days to all the points of the railway system; the railwaymen have furthermore at their disposal visiting doctors and in urgent cases they apply to private doctors.

The hospital attendance is given in institution with which the support fund has concluded a contract.

The family members benefit by the same advantages as the railwaymen.

One doctor controls, in each of the 3 dispensaries, the railwaymen attended in the hospitals, clinics or sanatoriums.

Travelling facilities are granted to a high extent.

The Railways do not possess an ambulance-car. The transport expenses are for account of the support fund or the railway system.

- b) *Piraeus-Athens-Peloponnesus Railways.*
(800 km — 3 100 railwaymen.)

The staff apply to the Railway doctors.

There is one hospital belonging to the mutual assistance fund. Such fund concluded contracts furthermore with many clinics.

That hospital attends wholly to all patients. It has a surgical section for

interventions without too much complication.

The chronic patients are admitted in the existing hospitals or sanatoriums.

The hospital is reserved on principle for the railwaymen, but in the proportion of the beds which are available. The family and encumbrance are admitted in the clinic of the mutual assistance fund; the expenses for account of the railwaymen are paid by monthly instalments.

The clinic works under the control of the mutual assistance fund, to which it belongs. The staff is represented on the board of direction of that fund.

No special travelling facilities are contemplated.

The assistance fund has at its disposal one ambulance-car.

8. Hungary.

Hungarian State Railways.
(7 764 km.)

The medical attendance by district, medicines, auxiliary therapeutic means are supplied free, as well as special attendance by district and hospital attendance. Latter is supplied in the Railway hospital or in a foreign hospital.

There is a railway hospital. Agreements have been concluded furthermore on a reciprocal basis with the State hospitals or other institutions of social security.

The Railway hospital supplies the first attendance but likewise complete attendance; one surgical section is annexed as well as one radiology service.

All the sections of that hospital possess the most modern complete equipment. Each medical sector comprises 2 and sometimes 3 sections with a chief doctor and assisting doctors in proper number and the sanitary staff.

Conventions with many sanatoriums or therapeutic institutions rule the hospital attendance and the treatment of tuberculous patients, rheumatics, asthmatics, etc.; all expenses being for account of the health-insurance fund. Those various

advantages are at the disposal likewise of the family members and the railwaymen's encumbrance.

The hospital works under the control of the health-insurance service of the Railways. It is under the control too of the authority of the health department. The health-insurance association applies the legal regulations relative to the maintenance of hospitals. The staff may intervene at the request of the committee of enterprise.

Free transport is allowed for medical attendance.

The company possesses ambulance-cars, but those existing in the country may be used too; the transport expenses are paid by the company.

9. Italy.

State Railways.
(± 15 900 km — 187 500 railwaymen.)

The staff applies to the district doctors.

The Railways do not possess hospitals, but have concluded conventions with many hospitals, sanatoriums, etc.

The railwaymen's encumbrance benefit by the same advantages.

Travelling facilities are granted for going to hospitals.

The Railways have no ambulance-cars. They call for transport for their account for injured railwaymen or those suddenly falling ill.

10. Luxemburg.

(± 500 km — 5 700 railwaymen;
± 4 150 other entitled persons.)

The railwaymen have free choice of the doctor provided that they are submitted eventually to the examination of a doctor approved by the company.

The approval of the medical mutual assistance is required if more than 2 consultations or visits per week are necessary.

The hospital attendance requires the previous authorisation of the support fund.

The company does not possess hospitals. Private hospitals supply the first medical attendance and attend likewise on boarded or travelling patients.

The hospitals are equipped in a modern way and possess a surgical section.

Tuberculous railwaymen or their family members are sent to Vianden (where there is a sanatorium for the men) or to Dudelange (sanatorium for women). These are private sanatoriums.

The railwaymen's encumbrance benefits by the same advantages.

The company possesses no ambulance-cars. The health-insurance fund or the mutual assistance organism bear all the expenses if the transport is made on a medical prescription. There are no other extra travelling commodities.

11. Norway.

State Railways.

(14 300 km — 26 600 railwaymen.)

Medical attendance is supplied gratis, with free choice of the doctors. Such advantages are allowed to the members of the health-insurance fund.

The Railways do not possess hospitals.

The hospital attendance is reserved to the members of the fund and their family (with exclusion of the encumbrance).

All the railwaymen are entitled to travelling permits for themselves, their wife and their children (up to 18 years of age).

The Railways do not possess ambulance-cars.

12. Netherlands and Colonies.

a) Netherlands Railways.

(± 3 400 km — 39 300 railwaymen.)

The railwaymen obtain the medical assistance, medicines, the hospital attendance and eventually appliances or extra attendance.

The « Association of the Railway staff

for fighting tuberculosis » has created an office for consultation and a provisional attendance institution, receiving contagious patients, previously to their transfer to a sanatorium.

If the railwaymen have their family subscribed in the support fund, the wife and children of less than 18 years of age benefit by the same advantages.

Travelling facilities are allowed to the wife and the children as an encumbrance till 25 years of age.

The Railways do not possess ambulance-cars. The eventual transport expenses are refunded.

b) East-India State Railways.

The railwaymen have free choice of the doctor, chemist and hospital.

The State intervenes financially when the expenses thereof exceed 5 % of the monthly salary.

13. Portugal and Colonies.

a) Portuguese Railway Company.

(± 3 500 km — 28 800 railwaymen.)

In important centers medical attendance and consultations take place in the medical posts. In other places the railwaymen have recourse to the regional doctors of the Railways. Facilities are allowed to them for acquiring medicines.

The Railway has no hospitals.

The families can have recourse to the medical posts for consultation and attendance.

The staff benefits by travelling facilities for going to hospitals; such free transport is not allowed to the encumbrance.

The Railway has no ambulance-car.

b) State Railways (Mozambique).

The medical assistance is supplied in help posts or in hospitals and clinics of the government.

There are special institutions for attending chronic diseases, but such institutions belong to the government.

The encumbrance benefits by hospital attendance.

The staff is not admitted to give suggestions about the working of such hospitals.

The transport to the hospital is free, even by air transport.

The company possesses ambulance-cars and the staff may use same gratuitously.

14. Sweden.

State Railways.

(\pm 13 500 km — 64 600 railwaymen.)

Medical attendance, hospital attendance and medicines are supplied.

The Railways possess no hospitals.

The advantages of the hospital attendance are reserved to the staff.

The staff benefits by usual travelling permits.

The Railways possess no ambulance-cars.

15. Switzerland.

a) Federal Railways.

(\pm 2 900 km — 38 800 railwaymen.)

No means are put by the Administration at the disposal of the staff.

The sick railwaymen have to get themselves the necessary medical assistance and to bear all the expenses, if they are not affiliated to a health-insurance fund (affiliation therein is not obligatory).

In case of absence on account of sickness, the sick man receives his full salary during six months, and then with a reduction which further increases after 3 subsequent months.

The Administration possesses no hospitals and no special institutions for attending chronic diseases.

The railwaymen may obtain extra travelling permits for being attended in a hospital, but their family does not benefit by the same advantage.

The Railways possess no ambulance-car. The eventual transport costs are for

account of the health-insurance fund or the national accident-compensation fund.

b) Bernese Alps Railways (Bern-Loetschberg-Simplon).

The affiliated applies to doctors and chemists having concluded a convention with the support fund on the base of tariffs fixed by the cantonal directions.

In case of no agreement therewith, the free choice is allowed.

The staff alone benefits by those advantages.

c) Emmental-Burgdorf-Thun Railways.

The Railways possess no hospital and no special institutions for attending on railwaymen suffering from chronic diseases.

16. Syria.

Damas, Hama and Extensions Railways.

(\pm 582 km — 1 624 railwaymen.)

The Administration puts no means at the disposal of the staff for the supply of medical attendance.

Private hospitals are bound by special contracts.

Travelling commodities are allowed for enabling the railwaymen to be attended in the hospitals.

The company possesses no ambulance-car. The transport expenses are for account of the Railways, in case of a working accident only.

17. Turkey.

Turkish State Railways and Harbours.

(\pm 7 600 km — 29 200 permanent railwaymen and 3 000 provisional railwaymen.)

The medical attendance, medicines and hospital attendance are supplied gratis.

The expenses are covered by the Railway budget and staff contributions.

The Railways possess, for their 32 200 railwaymen, 2 hospitals and 1 small hospital with 10 beds in the workshops at Sivas and in the seat of each district direc-

tion, one pharmacy depot in the seat of the general direction as well as 25 regional pharmacies.

The hospitals supply the whole attendance to the boarded railwaymen and the travelling patients.

The Railways have at their disposal 12.5 beds per 1 000 railwaymen.

The equipment of the hospitals is complete and comprises all the specialities. One polyclinic works there as well as a pharmacy for each hospital.

One surgical section exists in each hospital.

The creation of special institutions for attending chronic diseases is contemplated.

The hospital attendance is reserved to the railwaymen, their wives and children. Other medical attendance is allowed to other members of the encumbrance. Eventually such encumbrance may obtain hospital attendance at cost price.

The hospitals function directly under the authority of the general direction. There is a control by the competent department, to which Railway hospitals are submitted like the private institutions. The staff members have not to intervene in the working or administration of such hospitals.

The staff and encumbrance are allowed free transport for going to hospitals.

The Railways have one ambulance-car at their disposal, where there is one hospital. Such car is put at the disposal of railwaymen. In other localities agreements are concluded with local services, the expenses being always for account of the Railways.

GROUP 4.

2nd. Sub-group (Questions 15 to 27).

1. Austria.

Austrian Federal Railways.

Medical attendance is free and doctors do not collect fees either for attendance given to the agents nor for any given to members of their families.

The civil servants get their full salary during the period of illness. After an absence of one year they can be pensioned automatically.

The insurance organism of the federal Railways pays the benefits to the workmen.

The accidents which occur on the way to work are considered as work accidents.

The members of the families of agents on active service, the retired personnel and their families enjoy the same advantages as the agents on duty. However they pay a contribution of 20 % of the pharmaceutical expenses and the period of hospitalization is generally shorter.

The agents have nothing to pay to the specialists.

All medicines are free for the affiliates. Members of the family pay 20 %.

2. Belgium and Colony.

a) *Belgian National Railways Company.*

There are no Railway doctors moving around to give their attendance, and no mobile dispensaries are to be found.

Treatment to injured people is free but the patients are not directly taken care of by the medical service of the company.

In case of *sickness-unemployment* the statutory agent receives his full salary during 6, 9 or 12 months according to the number of years of work. He is 12 months absence the agent is put in a special department called « waiting section ». He remains there as long as there is a hope of recovery but the total amount of absence can not go beyond 3 years. The agent is then pensioned for premature incapacity. The pension is decided after a period from 6 to 12 months in case of full incapacity.

The agent who is inefficient to perform his work but who is efficient for other work can be submitted to a reeducation system. After that he is given a new job and obtains the salary equivalent to that of the new job. During the period of reeducation and of course, as long as he performs

some work he gets 100 % of his previous salary if he has not more than 6, 9 or 12 months of absence and then 75 % plus a bonus of encouragement from 5 to 15 %.

The agent who refuses the reeducation is put in the « waiting section » after an absence of 6 months and is pensioned in shorter time.

The agent who after a disease is temporary incapable of fulfilling his normal duties is progressively reeducated.

The agent injured or incapable because of a professional disease while on duty is paid 100 % of his salary during a period which can not be under 6 months nor go beyond one year.

If he has physically recovered but is temporary or permanently incapable to perform his normal work he is readapted or reeducated. This period accounts as a regular absence.

The agent submitted to one of these systems gets 100 % of his salary (maximum one year), 75 % during his stay in the waiting section, a bonus of encouragement going to 15 % or 25 % of his normal earnings or salary.

In case of permanent incapacity a statutory benefit fixed on the same way that the legal indemnity (without limit and with parallel equalization to these of the earnings or salaries) with which it can not be accumulated, is allotted in surplus of the treatment, salary or pension.

The agent who does not accept the reeducation is pensioned after passing in the waiting section and having an absence of 6 months or more (without going beyond 3 years for the whole of his career). While in the waiting section he obtains 75 % of his earnings or salary.

The accidents on the way to work are considered as work-accidents.

Members of families of active agents, of pensioned personnel are given the same privileges as the agents on service as regards medico-pharmaceutical cares, surgical operations, special treatments, hospitalizations and prosthesis.

All medical treatments and disciplines are available to the rightful claimants.

The cares given by specialists are reimbursed according to the rates established by the fund.

The personnel does not have convalescence homes.

b) *Société Nationale
des Chemins de fer Vicinaux.*

The company has allotted during two years a complementary indemnity to its effective agents (and ranking with) submitted to the legal system of social security in order to maintain a salary of 100 %.

A taking over of the work during at least 25 days in the course of the first year of absence entitles to a new indemnity period of two years. The taking over of the work must be of 75 days at least in the course of the second year to have the same effect.

When he has exhausted his rights the sick agent is struck off the lists. If he has ten years of work he gets, until he is 65 years old, an allowance equivalent to 1 % of his normal salary and this per year of work with the obligation to remain inefficient for any kind of work in the S. N. C. V. (Light Railways Cy) and not to take any sort of job which would be paid.

The agents who are not tied down to the social security get a total indemnity from 3 to 18 months and a part indemnity from 9 to 12 months according to the number of years of work. At the end of this part-indemnity period the agents incapable for good have to retire and get an annuity if they have at least 10 years of work. This annuity is reduced if they have not 10 years of work.

The problem of re-employment of semi-valid personnel does not occur for the workmen. As there are not enough light jobs or sedentary jobs to give them, the agents who can not be re-employed are sent to unemployment funds.

The company is self-insurer and applies the legal system to personnel injured on duty. Beside, the injured personnel on

duty have the same supplementary privileges as the patients until their case is confirmed. If the injured person takes over his previous job his salary is also maintained with deduction of the annuity which might have been granted. If he is not able to work anymore and has 10 years of work, he gets an incapacity or invalidity allowance until he is 65 years of age.

The accidents on the way to work are considered as work accidents.

The members of the family of active agents together with the retired personnel and their families get the same privileges as regards medico-pharmaceutical cares.

c) *Otraco*.

The light cases are dealt with by a medical agent from the dispensary or by a mobile medical agent; the other patients are directed to the nearest hospitalization centre.

The Railway doctors move about only for urgent cases.

Otraco has no mobile unit. The medical cares are entirely free and the patient has nothing to pay to the doctor.

The European agent who is sick gets his whole salary and complements during a period which may be restricted to 2 months. If after this time he is still incapable to work, he continues to get in Belgium 50 % of his salary during 3 months and to obtain free cares during this period.

The semi-valid person capable of work in a definite department in Africa is re-employed without reduction of his salary.

The European agent, who is injured, has the same advantages as the agent who is sick plus a special indemnity for permanent incapacity and assured by the colonial fund, plus a complementary allowance from the Otraco pensions fund. Besides he also receives an indemnity for incapacity or invalidity which is paid by the accidents insurance through Otraco.

This financial protection is never under 2 months in Africa.

The semi-valid agent capable of a certain service in Africa is re-employed in another job and gets a 100 % salary without taking into account the other indemnities he receives.

The accidents on the way to work are considered as work accidents.

The members of the families of active agents are the only ones who have a right to free treatment.

Complete, full medical cares, with the exception of dental prosthesis are granted to rightful claimers.

The fees of the specialists are refunded if they have given their services with the consent of the medical service.

The medicines (specialities included) are delivered free.

There are no convalescence homes for the staff.

3. Denmark.

State Railways.

The permanent staff gets, in case of illness its normal salary within very wide limits.

4. Spain.

Red Nacional de los Ferrocarriles Españoles.

The Social Welfare service of the Railways has a mobile sanitary unit with X-ray equipment and laboratory.

Cares to the staff are free and the same applies to the members of families of active agents.

The sick agent gets 50 % of his salary during 26 weeks and 40 % during the four following months.

The rightful claimers may obtain treatment from different specialists.

The medicines are free within the delays determined by the law.

5. Finland.

State Railways.

The state personnel goes to the consultation of one of the 88 areas' doctors — in serious cases, the Railway doctors go to private houses — they do not more about the network on determined days but are sometimes requested by the chief medical officer to visit certain unfrequented areas.

There is no mobile unit but only an X-ray waggon moving about the network to find out tuberculosis cases.

All medical cares are free — the Railways doctors can only, when the case applies, obtain their moving expenses.

The sick agent, who is so for more than 30 days in a year, loses one third of his basic salary. This deduction is brought to 50 % if the absence goes beyond i.e. 180 successive days.

If the disease is covered by the Company the full salary is then granted during 60 days. Injured personnel on duty can obtain :

- for themselves : attendance, daily indemnity, life annuity, further indemnities and their full salary;
- for the family : relief pension and funeral relief.

Accidents occurring on the way to work are considered as work-accidents.

Sickness-insurance does not exist outside the active agents themselves. There is however in certain workshops, relief funds with straight affiliation and free affiliation.

Fees of specialists are reimbursed if the agent was sent by a Railway doctor.

Only hospitalized workmen get free medicines.

There are no convalescent homes for the staff.

6. France. — Algeria and Tunisia, Colonies and Protectorates.

a) French National Railways.

The network is divided into medical sections which include the staff of small stations which can by this way consult their

district doctor or ask him to call. In urgent cases, the patient may call upon a private doctor who is then paid immediately (expenses reimbursed after justification). The Railway doctor is paid directly by the Railways without contribution of the agent.

There are no Railway doctors moving about on determined days in the network.

Each area has a number of mobile units with X-ray equipment in order to effect regular examinations and numerous ones either to find out tuberculosis or other special examinations. These mobile equipments move about in the whole of each district.

Members of the family have free choice of the doctor who is paid directly; the members are reimbursed through the providend fund.

Agents either sick, or injured whilst not on duty, receive until they are either dismissed or discharged :

- 3/4 of their salary during the first four days;
- their whole salary from the 5th to the 184th day;
- half of their salary from the 185th to the 365th day. After such a delay the agents are generally discharged.

Agents who have a lasting disease but which remains curable (tumors, tuberculosis) get (either if hospitalized or not) the entirety of their salary during 6, 12, 18, 24 months of illness, then half or two thirds of it according to their personal position, and this as long as they have not been dismissed, or put in disponibility or in case of illness without payment. The duration of absence with full or even part salary may not exceed 3 years.

The S. N. C. F. has taken various steps in order to re-employ the semi-valid personnel. First there is the easy work, then the taking over with certain reservations. The agent only resumes his normal work with the agreement of the medical service.

For the *agents injured* during the temporary incapacity period their full salary

is given if they call upon the Railways' doctor or have either his control or his agreement.

Medical and pharmaceutical expenses are covered by the Company.

In case of permanent incapacity the agent gets the indemnities provided by the law of the 10th October 1946 as regards survival annuity for the agent or his rightful claimers.

Members of the family of active agents, retired personnel and the members of their family obtain through the provident fund privileges at least equivalent to those provided by the legal system of social security.

All current medical attendance and specialist treatment are granted.

All medicines including specialities are entirely reimbursed to the agent who calls on a Railway doctor. The members of the family pay 20 % (ticket modérateur). They have free choice of the doctor.

The consultations and cares given by Railway specialists are free. The expenses are reimbursed when a call on a doctor foreign to the Railways can be fully justified, in case of urgency for example.

Accidents which occur on the way to work are legally considered as work accidents if the way taken was the shortest and if the agent did not stop or loaf around.

b) *Régie Autonome des Transports parisiens.*

All medical attendance is entirely free.

Permanent agents who are sick obtain sick leaves with full pay during a maximum period of 365 following days. After this period and if the recovering or the healing is foreseen, but if a long period of care or treatment is necessary, special leaves for long illness are granted (half or two thirds of the salary if there are at least 3 dependent children).

Agents incapable for their work after sickness are used in other jobs. Agents who have become permanently incapable

are dismissed and obtain either an incapacity annuity or a pension.

Special holidays are granted to tuberculous, cancerous, mental patients but they cannot last more than 3 years with full salary and 2 years with half salary.

Work-accidents and professionally incapacitated patients have their full salary until they recover completely. Semi-valid personnel is when possible re-employed in other jobs.

The agents permanently incapable are paid an annuity as long as they do not get a salary equivalent to their previous one.

Accidents which occur on the way to work are considered as work accidents if the way taken is the regular one.

Families of agents, retired personnel and their families are covered by the conditions of the general system of social security if affiliated to the mutual fund of coordination.

All current medical cares and specialists cares are granted. The staff has always the opportunity to be taken care of by approved specialists.

The State control has a convalescent home in Menetreux. Moreover the agents can be sent to other homes approved by the social security organisation.

c) *Algerian Railways.*

Agents able to move go to the consultation of the district. Those who are not, have the doctor coming to see them. In urgent cases they can call on a doctor they choose, and of course the nearest. All expenses are reimbursed.

There are no travelling Railway doctors and no mobile dispensaries.

All cares granted by doctors of the network are entirely free.

Sick agents get their total salary during 120 days and half of it during 90 days. Convalescent agents are used in normal work but not as long as usual and they obtain their full salary. They may also, after agreement with the medical service

of the network, be transferred to a lower grade.

Injured agents are paid until they take over work or are dismissed and unless they state being satisfied with the law they get their full salary plus family charges. Any bonus is reduced or cancelled. Bachelors, sent into hospitals, get only half of their salary as they have no dependents.

These agents also have free attendance, medicines and hospitalization. Injured agents non-healed and re-employed in a department which is not their usual one obtain their salary, bonus and extra salary.

In case of permanent incapacity the agents are dismissed or discharged or kept in their job or transferred to other jobs or other grades. The decision to keep them at work is only taken after establishing the rate of legal indemnity they have to receive. The fact to keep them at work is a means of reparation replacing an annuity; and the latter is thus suspended until the agent stops being a member of the personnel.

Any agent who has been transferred to another grade or another job because of a work-accident gets the salary of the new job plus a supplement equivalent to the difference between the previous job and the new one.

Accidents on the way to work are not considered as work-accidents except in certain cases determined by statute law. Families of agents who do not get more than 213 420 fr. have a right to free medicines but not to hospitalization.

Retired agents living in Algeria have free medical cares granted to them by the medical services but only against a voucher.

Retired agents living in France have free medical cares if going to the consulting-rooms of the Railways or to the private consulting-rooms of these doctors.

General medical cares and specialists cares are granted. Prevention against swamp fever is specially undertaken.

The attendance of most of the specialists is free, but the agent has to pay certain special examinations such as: X-rays, intubations, electrocardiograms, analysis, etc.

Tuberculous and cancerous have all examinations and special treatments or cares completely free.

Medicines, equipments and bandages, etc., are given free.

The issue of specialities is strictly forbidden except for certain products entirely free (penicillin, quinine, vitamins, etc.).

The chief medical officer may however authorize certain specialities which cannot be replaced by others.

d) *Gafsa Railways.*

The doctors go to the small stations if called by the agents but do not go on determined days. There is no mobile dispensary. Treatment is free for the agents but not for members of the family.

Sick commissioned agents are entitled to 120 days with full salary and to 90 days with half salary; the others: to 30 days with half salary. For all however there is an unpaid period of 4 days.

Commissioned agents, injured on duty get their full salary during the temporary incapacity period. To other agents the 1898 law is applied. This is also in force for all cases of permanent incapacity or death.

The cares given by the specialists and operations must be paid for by the personnel but the expenses can be spread over several months.

General medicines are free.

There are no convalescent homes for the staff.

e) *Compagnie fermière des Chemins de fer tunisiens.*

The sick agent goes to the district doctor's consulting-room. In case of urgency they may call for the doctor who comes to see them. The doctors who belong to the public health service are obliged to make regular rounds.

All cares are free for the agents and for the members of their families who go to the dispensary.

Commissioned agents get:

— full salary from the 5th day and for a maximum of 120 days per year;

— half of their salary for a period which can not go beyond 90 days after the preceeding period.

Allowances are reduced by half for bachelors hospitalized who have nobody at charge.

By exceptional decision of the director of the Company, the periods of full salary can be exceeded.

Auxiliary but permanent agents are placed :

— without salary the first 4 days of each stoppage;

— on half of their salary during maximum 30 working days per year.

Commissioned agents who have become unable to fulfill their work are re-employed in other jobs either equivalent or below (on request) or dismissed.

Auxiliary agents are either retired or discharged.

The agents, either victims of accidents or of professional disease, get :

if they are *permanent* : full salary until taking over work or being dismissed;

if they are *auxiliary* : half of their salary until they are fit.

The Company endeavours to re-use for the best the commissioned staff with work-incapacity if this incapacity is not full.

Indemnity : the auxiliary personnel receives an accident-annuity. The statutory personnel is if possible kept in working position and the payment of the annuity is suspended until they retire.

If there is total incapacity the agent is discharged and receives his retirement allowance plus an accident annuity.

All medical cares are granted to railwaymen.

Expenses for treatment given by specialist are not reimbursed if they are given outside the dispensaries.

The cost of the medicines (with exception of the specialities) is reimbursed to agents who do not earn more than 239 000 francs.

f) *French Equatorial Africa Railways.*

The medical cares and surgical operations are all free.

The medicines are to be paid by the agent except in case of hospitalization.

g) *West Africa Colonial Railways.*

The agents are taken care of by the district doctor who sends them, if necessary, to the nearest hospital.

The retired personnel is accepted in hospitals just as the active agents.

Days of work lost because of work accidents are indemnified.

Permanent incapacity is also indemnified. If it is a complete incapacity, an annuity is paid according to regulations provided in 1932 decree.

If the incapacity is only a part incapacity the agent remains on duty and keeps his previous salary. If he is dismissed a special indemnity is allotted.

Accidents on the way to work are not considered as work-accidents.

Members of the family have free treatment in colonial sanitary centres.

Expenses for treatment given by specialists are reimbursed on approval of the doctor consulted. Same applies to medicines including specialities.

There is a convalescent centre which is the same for all agents of the « Régie » and of the public services.

h) *Franco-Ethiopian Railways.*

The personnel benefits by medical rounds and of pharmaceutical rounds which are regularly established (at least once per month). They also have in urgent cases doctors or nurses coming to see them.

There are mobile dispensaries.

Treatment is free for the agents and their families.

The agents injured and healed but with an infirmity get an annuity as long as this infirmity remains and as long as the salary is reduced.

As regards accidents on the way to work the Company follows the French legislation.

The personnel receives all case which can be possibly given, taking account of the local means.

Treatment by specialists is reimbursed within certain limits and if it is given with approval of the medical service of the Company.

Medicines are provided free. There are no convalescent homes at disposal of the personnel.

i) *Indo-China Colonial Railways.*

The sick personnel is taken care of by the district doctor or is hospitalised in case of serious disease.

Railway doctors move about within their districts.

There are mobile dispensaries.

Treatment of agents and their families is free.

Full salary is paid to injured personnel until recovering or healing of the injury. Sometimes they are dismissed for inefficiency but they get a special indemnity.

Accidents on the way to work are considered as work-accidents.

All general medical cares are granted together with medicines in prevention of certain tropical diseases.

Specialities are free if the patient is hospitalized — in the other cases they are to be paid by him. General medicines are free.

j) *Morocco Railways.*

The medical service is done by approved doctors and nurses.

When necessary the hospitals of the protectorate are called upon.

There are convalescent or summer centres and beneficiaries give a small contribution.

7. Greece.

a) *State Railways.*

Ordinary attendance is given by doctors who go round the network.

For important or serious treatment the agent must apply to the medical service of one of the centres. In urgent cases any doctor may be called (expenses reimbursed on request).

There are no mobile dispensaries.

Attendance is free for the agents only.

The injured or sick agent gets two thirds of his salary from the 5th day and during 4 months per year. The deduction of the 4 first days pay can be reimbursed by medical decision and in very serious cases.

This indemnity is given, for the injured agent, through the mutual relief fund. After that period and until the end of the year the salary is for the account of the Railway. The fund takes over the expenses for four months and then the Railway has to intervene for the rest of the time.

In case of complete incapacity the agents are covered by the fund during four months and then covered by the Railway until they retire.

In both cases the difference between the salary and the sum paid by the fund is paid by the Railway.

The agents and the members of their families get free medical and pharmaceutical expenses, prosthesis, surgical operations, hospitalization (3 and 2 months) sanatorium (1 year for the agents, 2 — 4 months for the family).

All medical cares and all medicines are granted to sick or injured agents.

The Railway reimburses the expenses for urgency help given by any doctor or any specialist.

The medicines are reimbursed when prescribed by a Railway doctor.

b) *Piraeus-Athens-Peloponnesus Railways.*

Every doctor answers a call from a sick agent but the agent has to go by himself to a specialist.

There is no mobile dispensary.

Treatment is entirely free for the agents and other dependent persons.

The sick agent gets the two third of his salary (half of it in case of hospitalization) maximum : 4 months per year. Then the

Railway grants half of the salary during two years.

Tuberculous are covered by the fund during 7 months, then covered by the network during 5 months, and after they have to retire with special privileges.

Injured personnel gets the two third of the salary (half in case of hospitalization) plus a complement covered by the Railway to complete the 100 % of the monthly salary. Duration: 4 months per year. After these four months the Railway gives 50 % during two years and after this period the agent is retired.

Accidents on the way to work are considered as work accidents.

Members of the agent's family have the same advantages as himself except hospitalization which is however granted in case of surgical operations.

The retired personnel and their families do not get any privileges.

All medical cares are given to the staff without limit.

The medical service has specialists whose attendance is free. If the agent asks for another specialist, the expenses are reimbursed after control.

All medicines and specialities are issued free.

There are no convalescent homes.

8. Hungary.

State Railways.

District doctors give their cares to agents working far from the big cities. Special cares are given by the district doctor who is the nearest and in case of emergency even by a non Railways doctor. The expenses are reimbursed.

There are no Railways doctors moving around the network and no mobile dispensaries except for big Railways accidents.

The Railways doctors do not get a fee from the agent or from dependents.

About 92 % of the personnel receive full salary during sickness or convalescence. 8 % receive alimony. The pension is fixed immediately after the cessation of work —

if the disease takes place prior to the pension the indemnity is 100 %.

The medical treatment is free for the agents' families, the retired personnel and their families; they contribute a small part for medicines and other therapeutic expenses.

All medical cares are granted to the railwaymen; medicines, even specialities are completely free. Specialist Railway doctors give their cares free of charge to the agents and to their families. If the help of another specialist is necessary all expenses are reimbursed.

Accidents on the way to work are considered as work accidents.

9. Italy.

State Railways.

Personnel distant from the big cities is taken care of by district doctors. Some of them have quadricycles or « draisines ».

In certain isolated areas Railway doctors move around on determined days. There are no mobile dispensaries.

The general diseases are taken care of against payment of normal fees which are reimbursed afterwards. The cares given to victims of work accidents, professional diseases and malaria victims are all free.

The Railway doctors are paid by the members of the family who call upon them except if they are victims of malaria.

The patient is entitled to his full salary during 270 days generally and never less than 180 days. The absence may then be prolonged to one year or to 18 months with 1/3, half or two thirds of the salary.

The non statutory obligatory-insured by the Provident Fund Institution lose the totality of their salary during the first two days of illness and get about 42 % of their salary from the 3rd to the 120th day.

An injured agent obtains during an absence due to temporary incapacity the ordinary salary established for sickness-absences but the lasting is not limited. When possible the semi-valid persons are

re-employed in jobs proportional to their capacity.

An annuity is allotted in case of work-incapacity of 10 % (20 % for professional diseases). The control of this annuity may be undertaken until the 10th year. With 80 % one becomes full invalid and a special financial and moral assistance or help is granted.

Only accidents which occur on the way to are considered as work-accidents.

Dependent persons obtain special privileges resulting from their registration in the Provident Fund Institution.

The agents are authorized to consult at the cost of the Railway any specialists independent of the Railway if they do not have the opportunity to consult Railway specialists.

All medicines are free for personnel injured on duty, sick patients and the victims of malaria. For the other diseases the reimbursement is limited.

10. Luxembourg.

Luxembourg Railways.

There are enough doctors everywhere to enable the agents to get all necessary cares without difficulty. There are no moving Railway doctors and no mobile dispensaries.

The agents get free treatment if they belong to the area; the others have to contribute a certain part of the expenses. Same applies to members of the family who have to pay 20 % of the medicines expenses.

The sick agents of the area may get their full salary until they retire.

To other agents the Railway pays 75 %, 40 to 60 % of which are reimbursed through the sickness-fund. There is a deduction of three days but it is cancelled if the disease lasts more than 14 days.

The sickness-fund also pays an hospitalization maximum of 26 weeks.

In case of hospitalization the married affiliates get the family relief and the

bachelors get the pocket money relief (20 to 25 % of the average salary).

Agents who after a long and serious disease need a certain reeducation are used in an easy department.

Agents injured on duty obtain :

- free cares and hospitalization;
- full salary during the totality of the absence or until retirement;
- a retirement pension or a pension to the widow and to the orphans in case of death.

Accidents which occur on the way to work are considered as work-accidents.

The members of the family affiliated to the « Medical Aid » (*Entr'aide Médicale*) are entitled to the reimbursement of the medical and pharmaceutical expenses, of the hospitalization, and recovery treatment expenses, etc.

All necessary medical cares are granted.

Expenses as a result of specialists' services are reimbursed at the official rate.

11. Norway.

State Railways.

The personnel distant from the large centres must consult or call the nearest doctor. There are no moving Railway doctors and no mobile dispensaries; free services are given to members of the sickness-fund.

The agents do not pay the Railway doctors but the members of the family have got to pay them.

The agent either injured or sick is entitled to his full salary during a period of 12 months.

Accidents which occur on the way to work are not considered as work-accidents.

The members of the family have all medical care free.

All medical cares are free for the agents and the medicines are partly free. Prosthesis to victims of work-accidents are covered by the Administration.

The specialists expenses are generally reimbursed.

All medicines including the specialities are partly free.

12. Netherlands and Colonies.

a) *Dutch Railways.*

The personnel is taken care of by the doctor of the area or by the nearest one.

There are no moving Railway doctors and no mobile dispensaries.

The agent does not pay the doctor if he is member of the Welfare Fund and it is this one which pays by subscriptions; same applies to the members of the family.

The agent, either injured or sick, obtains:

- his full salary during one year;
- 70 % of his salary during the second and the third year. This amount is brought to 100 % during as many months as the agent has years of work (with a maximum of 12 months).

After one year of permanent incapacity, the agent is put to retirement. The retirement pension is completed during one year at 70 % of the last salary given.

The semi-valid persons are used in a job which suits them but keep their previous salary.

Accidents which occur on the way to work are considered as work-accidents if they are not due to carelessness and if the way taken is the shortest.

The rightful claimers affiliated to the fund obtain more extended cares such as hospitalization, specialities, etc.

The expenses as a result of services given by specialists are reimbursed together with the medicines including any specialities.

The staff has formed three associations to run convalescent homes. The Administration grants subsidies.

b) *State Railways in the Dutch Indies.*

The victims of work-accidents and sick patients obtain an increased pension. A free mutual insurance to which almost all the agents are affiliated, grants an indem-

nity in case of permanent incapacity or to the next of kin in case of fatal accident.

The agent has free choice of the doctor, the chemist and of the hospital. The state intervenes if the expenses reach more than 5 % of the monthly salary, and in prosthesis expenses.

13. Portugal and Colonies.

a) *Portuguese Railway Company.*

The company staff is attended by district doctors. There are neither travelling Railway doctors nor moving dispensaries.

Such doctors receive normal fees, either from the company staff or their encumbrance.

Tuberculous employed receive a complete salary. As far as other patients are concerned, their salary is reduced till the 10th day of unemployment caused by sickness, respectively by 50 %, 30 %, 20 % or 10 %, if they are in the service since respectively less than 10 years, from 10 to 15 years, from 15 to 20 years or more than 20 years.

From the 10th day of unemployment, every salary is reduced by 50 %. Should the worker be absent during two years, he is then discharged or pensioned at the end of the 2nd year.

Semi-valids are given a lighter service.

Injured obtain, in case of a complete temporary incapacity, 1/3 of that salary during the first three days of incapacity and then 2/3 thereof. A partial permanent work incapacity entitles the injured to 2/3 of the reduction. A complete permanent incapacity entitles him to 2/3 of the annual salary.

An accident occurring on the way to work is not considered as being a working accident.

Families, retired and encumbrance are not entitled to enjoy the aforesaid advantages.

Medical assistance and, in case of accident, surgical assistance are supplied to the staff. Attendance by specialists is refunded by exception, as well as medicines.

b) *State Railways (Mozambique).*

The staff has recourse to visits of Railway doctors and travelling nurses. There are no moving infirmaries.

Such doctors do not receive fees either from families or from the staff.

Injured at work are allowed till their complete healing the whole of their salary. In case of a permanent incapacity, they are allowed a pension equal to a maximum of the 2/3 of the salary (as far as workmen are concerned) or to the retired pension for officials).

Any accident occurring on the way to work is not considered as a working accident.

The members of the family benefit by same medical-pharmaceutical assistance as the staff.

All medical assistance is supplied. Attendance by specialists is gratuitous, as well as medicines, should the monthly remuneration not be higher than £ 40.

14. Sweden.

State Railways.

The staff applies to the nearest Railway doctor. There are neither travelling Railway doctors nor moving dispensaries.

Doctors are paid directly by the Administration, when the staff is concerned — the members of the family however have to pay the doctor's attendance.

Sick Railway workers are paid according to special rates.

The pensioning off is generally considered after one year of sickness.

Semi-valids are allowed easier conditions of service.

The injured staff receives a whole remuneration during his absence. The pensioning off is considered after one year of absence.

A pension for life is sometimes allowed.

An accident occurring on the way to the work is assimilated to working accidents.

The members of the staff family, the retired and their family do not benefit by medico-pharmaceutical assistance.

Medical attendance, including attendance by specialists, hospital attendance, medicines, prosthesis, etc., are supplied to the staff.

Attendance by specialists is refunded to the extent of 3/4.

Medicines, including pharmaceutical specialties are supplied gratuitous. There are no convalescence institutions.

15. Switzerland.

a) *Federal Railways.*

The whole staff is attended by freely selected doctors. There are no travelling Railway doctors nor moving dispensaries.

Official doctors do not attend the staff.

All doctors called by sick workers are paid by the patients or through their health-funds.

Sick workers receive the whole salary during 6 months, 75 % thereof during the following 3 months and 50 % till the resumption of work or the retirement.

Half-valids receive a salary corresponding to the work supplied. As far as the previous and the new salary is concerned, they are allowed a pension, calculated on the years of service or the invalidity caused by an accident.

Injured at work receive their whole salary till their retirement or resumption of work. If they resume work, as partial invalids, their salary, the pension and supplements allowed to themselves reconstitute what they received on the date of the accident.

They are allowed furthermore the normal or extraordinary salary increases which they would have obtained if they had not been injured.

Accidents occurring on the way to the work are only assimilated to working accidents, when the victims thereof were already on Railway property.

The family members of the staff do not benefit by the medical assistance.

b) *Bernese Alps Railways*
(*Berne-Loetschberg-Simplon*).

Medical attendance is given by the nearest doctor. There are neither travelling doctors on the Railway lines, nor moving dispensaries.

Medical expenses are paid by the health-funds, recovering 10 to 20 % from the affiliated. All workers absent on account of sickness are allowed 75 % of their salary during 185 days and 40 % during the following 180 days. Workers meeting with working accidents are allowed free medical attendance and indemnification for sickness and loss of remuneration and a partial pension corresponding to the balance between the new and the previous salary.

Complete medical attendance is supplied.

The fees of specialists are refunded but a share thereof is for account of the worker.

Medicines and some pharmaceutical preparations are supplied but a share of the cost is paid by the worker.

c) *Emmental-Burgdorf-Thun Railways*.

The sick Railway staff receives a full salary during 3 months, then 75 % during 3 months and 50 to 60 % during 6 months.

Injured at work receive during their whole absence a full salary (80 % of which are at the expenses of the accident insurance office).

Accidents occurring on the way to the work are not assimilated to working accidents.

The Railway staff and his family are insured by public insurance institutions.

16. Syria.

Damas-Hama and extension Railways.

The Railway staff is supplied with medical assistance thanks to the periodic tours effected by the Railway doctors (one tour per week effected by the two appointed doctors).

The Railway staff and the staff families are given medical attendance gratuitously. There are no moving dispensaries.

The sick staff can obtain a 6 months' holiday for sickness, paid per annum, 3 months of which with full salary and 3 months with 1/2 salary. Semi-valids are not re-employed.

Injured on service have the whole salary during 6 months and can obtain subsequently an indemnification proportional to the incapacity extent.

The case of accidents occurring on the way to the working site has not been fixed by the law.

Medical attendance required by all diseases is supplied.

The fees of the oto-rhino-laryngologist doctors are refunded.

Medicines including pharmaceutical specialties are supplied gratuitously.

There are no convalescence institutions.

Railways and Harbours
of the Turkish State.

The district doctors make regular tours and go immediately in urgent cases to the patient's house.

The creation of a dispensary waggon in each district is contemplated.

Railway doctors do not receive fees. They are paid by the Railway.

The period of an unemployment owing to sickness, during which the salary is paid, varies according to the number of the years of service, but it reaches one year as a minimum.

Periods are doubled when tuberculous persons are concerned.

Provisional and not immatriculated Railway workmen do not receive any remuneration, except when they are absent owing to accident at work or professional diseases.

Injured at work retain their whole rights till complete healing, without any time limitation. In case of final inaptitude, they obtain a pension equal to that allowed after 30 years of service.

Provisional and not immatriculated workmen are treated in accordance with the law's regulations.

An accident occurring on the way to work is not assimilated to working accidents.

Complete medical attendance is supplied gratis to the Railway staff.

Specialists' fees are paid directly by the Railway or refunded, in urgent cases, to the staff.

Medicines, including pharmaceutical specialities are supplied gratuitously. There are no convalescence institutions.

ANSWERS.

3rd Sub-group (Questions Nr 22 to 33).

1. Austria.

Austrian Federal Railways.

The Railway staff has to be attended by the Railway doctor.

Female workers or clerks obtain free medical and midwife's attendance, one lot of medicines necessary to the confinement and 50 sh. for further expenses. They are allowed furthermore a confinement indemnity equal to 12 weeks of salary (6 before and 6 after the confinement), as well as a nursing compensation during 183 days, equal to 1/4 of the basic salary, but not exceeding 2 1/2 sh. per day.

Female Railway officials are entitled to the medical and midwife's attendance, one lot of medicines, one compensation equal to 10 % of the sums received in the course of the month of the child's birth (without exceeding 115.60 sh.), one support allowance during 60 days, equal per day to 3/4 of the amounts received during the month of the child's birth, as well as a nursing compensation during 30 days, equal to the allowance mentioned.

The wives of workmen and clerks have the same advantages as female workers and clerks, but the confinement compensation is only allowed during 8 weeks.

The wives of Railway officials and pensioned men enjoy the same advantages as female officials except the 10 % compensation and the support allowance.

In case of death, an allowance equal to the triple of the last monthly remuneration is granted.

The sickness insurance pays for about 75 % of the prosthesis expenses. That attendance is supplied free for working-accident victims, according to their need or utility.

2. Belgium and Colony.

a) *Belgian National Railways.*

Medical attendance is under unilateral direction, i.e., it is ruled by medical services depending on the direction of personnel and social services.

There is no staff support fund in the medical services. The staff makes free choice of a doctor, a chemist and nursing home.

The female staff is entitled to :

- one holiday with full salary during 60 days (20 before and 40 days after the confinement);
- on the expiration of that leave and on application, to a nursing leave with a maximum duration of 6 months, without remuneration but with maintenance of all rights for promotion, medical attendance and the pension;
- to the refundment of the confinement expenses to the extent of the tariff applied;
- to a subvention of 200 francs per child for the layette;
- when the family allocations are paid by the Railway company, to a monthly subvention of 500 francs per child nursed by the mother herself wholly or partially, during the nursing period (maximum 6 months).

The wives of entitled or retired Railway staff obtain :

- the refunding to the extent of the tariff of the confinement expenses;
- the compensation for the layette : 200 francs per child;
- a monthly subvention of 500 francs per child nursed by the mother herself, wholly or partially during the nursing period (maximum 6 months).

In case of death of a Railway worker during employment, the widow is allowed an indemnity equal to 1 month of total gross remuneration.

The working-accident victims obtain free the prosthesis required by their injuries.

The patients obtain therefore :

- prosthesis of members, orthopedic and thoracic appliances, at the exclusive expense of the support fund;
- bandages, to the extent of the tariff of the support fund;
- teeth-prosthesis, to the extent of the tariff of the support fund inasmuch as the mastication coefficient does not exceed 3;
- the disposal of auditory appliances;
- the refunding of spectacle expenses to the extent of the tariff.

b) *Société Nationale
des Chemins de fer Vicinaux.*

The health insurance service to which all the workers not ruled by the legal social organisation must be affiliated, functions as an usual support safety fund.

It limits its action in allowing compensations for the expenses borne by the affiliated and their family. That service is managed by a committee of the parity-form. The support fund is fed by equal parts by the quotas of the affiliated members and the company.

The staff makes free choice of the doctor, chemist and nursing home.

The female staff ruled by the social safety organisation obtain :

- one 12 weeks' confinement-leave; the legal indemnification is completed by the company to the extent of the nett remuneration on active service;
- a subvention of 1 800 francs or 900 francs (according to whether it concerns a first or a second birth) for account of the social security organisation, in addition to participations in medical expenses;
- a subvention of 200 francs for the baby-linen.

The female staff not ruled by the social security organisation obtain :

- one holiday of 2 months normally paid;
- one birth compensation of 500 francs;
- one subvention of 200 francs for the layette (the 2 latter are allowed by the health-insurance service of the company);
- a sharing of the company in the medical expenses;
- a birth subvention (family allocation fund).

Both classes of workers obtain furthermore :

one lot of layettes, a nursing subvention, etc.

The wives of staff on active service and the wives of retired men, ruled by the social security organisation, obtain :

- the intervention in medical expenses;
- the birth subvention of 1 800 or 900 francs;
- the layette subvention of 200 francs;
- a layette lot worth 500 francs;
- a monthly nursing subvention of 500 francs, during 6 months.

The wives of the staff on active service and the wives of the retired men, not ruled by the social security organisation obtain : those advantages + one compensation of 500 francs.

On the death of the married staff or pensioned men, the rightful claimants obtain one month's salary or pension.

The social security organisation of the S. A. M. intervenes in the cost of prosthesis.

As far as the working injured are concerned, that question is settled by the law's regulations.

c) Otraco.

Medical services are managed unilaterally.

Otraco undertakes all charges and has the management of the fund.

The staff has free choice of doctors in Leopoldville only and as far as Europeans only are concerned.

The female native staff obtains two month's holiday before and 1 month's holiday after confinement. The European female staff does not benefit by any subvention.

The native wives of the staff obtain an extra ration, 3 months before confinement; one extra suckling ration, 6 months after confinement; layette subventions; subventions for regular attendance at the nursing centre.

A death allowance is paid to the natives.

The Otraco pays wholly or partly the costs of prostheses when they are indispensable for obtaining a normal production. They always pay all the costs for prosthesis of the working accidents victims.

3. Denmark.

State Railways.

The State Railways allow a subvention to the health-insurance fund constituted by the staff and supply also staff and rooms.

The fund pays a allowance on the death of the workers or pensioned men.

4. Spain.

Red Nacional de los Ferrocarriles Españoles.

Female staff receive 60 % of their salary, 6 weeks before and 6 weeks after the confinement. The Railway company adds thereto a subvention of 30 % during the same period.

A 10 weeks' nursing subvention is allowed for a simple birth and a 15 weeks' subvention for a multiple birth.

The social security organisation of the Railways supplies layettes and linen to the women attending the prebirth-visits.

In case of death of a worker on active service, 20 days of salary + 3 months of normal remuneration are paid.

5. Finland.

State Railways.

Medical services are managed unilaterally. Their budget is included in the general budget.

The staff has no free choice of doctors, chemists, nursing homes.

A 2 months' maternity holiday is foreseen.

A subvention on the death of a worker on active service may be allowed on special application.

The medical service does not intervene in the prosthesis allowance.

6. France. — Algeria and Tunisia, Colonies and Protectorates.

French National Railways.

Medical services are controlled by the Railway direction of each region and are managed by such direction. The staff, represented in the various organisations constituted with the institution and service chiefs, is kept informed, in this manner, of the working and the efforts effected, but there is no real co-gestion with participation of parity organisms.

Retired workers do not benefit by the medical services of the S. N. C. F. These are ruled by special regulations.

The annual budget of the medical services is established according to the results of the previous year. It is included in the general budget of the S. N. C. F., which provides the funds without participation of the staff on active service or the retired-men.

The staff has no free choice of a doctor (except as far as teeth attendance or surgical interventions are concerned), but has free choice of the nursing home or chemists.

A maternity holiday of 14 weeks is allowed to the female staff (6 weeks before and 8 weeks after confinement).

The *charwomen* receive on occasion of a birth :

- a maternity subvention, on the condition that the birth should take place either within a certain period after the marriage, or after a previous gestation or before the 25th birthday of the mother;
- when the birth does not imply the payment of the maternity subvention, the support fund allows a subvention of 1 500 francs for the first birth, increased by 1 000 francs for each eventual subsequent birth.

The female staff benefits by free medical pre-natal visits and 1 medical post-natal visit.

The support fund undertakes all the costs of the confinement, in a public hospital or an agreed institution. Should the wife be confined at home or in a private institution, she receives a lump allocation including the confinement expenses and the medical attendance during the subsequent 12 days.

She may also obtain the refunding of a pregnancy belt at the official tariff.

Finally, she obtains :

- either monthly nursing subventions :
1 300 francs during 4 months, then
810 francs during 2 months;

- or milk tickets : 500 francs during
4 months, then 300 francs during
2 months.

The wife of a worker or retired man, who does not benefit herself by the qualification of a social assured, obtains identical advantages.

A layette subvention is not allowed.

Death subventions are paid : to the worker on the death of his wife or of a child under age — to the heirs of the worker deceased :

- to the affiliated retired men, on the death of the wife or of a child under age;
- to the heirs of the deceased, retired, affiliated worker;
- to the heirs of the widow of the retired, deceased affiliated worker.

The medical service supplies the prosthesis but the worker has free choice to obtain same. The support fund refunds wholly or partially, according to its regulations.

b) *Régie autonome des Transports parisiens.*

The staff controls the management and the working of the medical services through a support fund, administered by a committee of 27 members, elected by the staff on the conditions fixed by the special regulations of the fund.

The retired men do not participate in the management.

The budget is established every year according to the results of the previous year and the possible previsions. The expenses are defrayed by the Administration and booked in the working account.

The gratuity is only allowed when applying to doctors and chemists approved by the Administration.

The female staff obtains a maternity leave of 14 weeks + a nursing holiday, without salary (18 months as a maximum) : a nursing subvention of 6 820 francs to be divided into a period of 7 months

(5 520 francs as far as mixed nursing is concerned).

When nursing is impossible for medical reasons, milk tickets are allowed: 750 fr. for each of the first 4 months, 300 francs for each of the following 3 months — as far as hygienic milk is concerned: 500 and 200 francs for ordinary milk.

The wives of workers or retired men benefit by subventions of the mutual co-ordination fund, according to the regulations of the general rules of the social security organisation.

In case of death, an indemnification is paid, equal to 1/4 of the latest yearly salary of the defunct + a lump subvention, on the condition that the funerals are at least 7th class funerals.

The rightful claimants of deceased retired men do not obtain any indemnification.

The fund repays wholly or partially the prosthesis expenses prescribed or justified by an approved doctor.

The disputed-claims office of the company bears the prosthesis expenses for the working injured.

c) *Algerian Railways.*

The medical services are administered unilaterally. Budget provisions are based on the results of the 18 previous months and on the prospects of the year. The budget is deducted from the company budget, which is fed by the resources of Algeria.

The working injured alone have free choice of a doctor.

The female staff obtain one maternity leave of 12 weeks (6 weeks before and 6 weeks after confinement). In addition to such periods, certified absences are assimilated to normal sickness. Provision is made for authorised absences of one hour per day during one year for nursing. There is no provisions in favour of wives workers or retired workers.

No indemnification is allowed for confinement expenses, layette or nursing.

Subventions are paid on the death of workmen on active service.

On the death of a retired worker, the direction may allow an exceptional support on application.

The medical services do not intervene in the prostheses.

The injured at work are ruled by legal provisions concerning the attribution and renewing of the prostheses. A service of appliances gives directions to the victims, attends to testing of the appliances and authorises repairing, etc.

d) *The Gafsa Railways.*

Medical services are managed unilaterally and are for account of the exploitation budget.

The staff has free choice of doctors, chemists and nursing homes.

The female staff obtains a maternity leave of 3 months. No subventions or compensations are allowed.

The employer gives to the employee a subvention on the occasion of each birth.

There is no death compensation, but poor families are assisted.

Medical services do not intervene in the supply of prostheses.

The law's regulations are applied as far as working injured are concerned.

e) *Compagnie fermière des Chemins de fer tunisiens.*

Medical services are managed unilaterally.

There is no special budget, as all the costs are for account of the Company.

The staff has no free choice of doctors, chemists and hospitals.

The commissioned female staff obtains a maternity leave of 8 weeks.

There is no special subvention. No provision is made in favour of the wives of workers or retired workers.

Special prices are allowed concerning stays in maternity hospitals; there are pre-natal and post-natal visits, and nursing consulting rooms.

A subvention for funeral expenses is allowed to the rightful claimants of entitled workers deceased on active service.

Prosthesis for working injured is supplied free until complete recovery. Medical services do not intervene in the prosthesis of patients.

f) *French Equatorial Africa Railways.*

No answer.

g) *French Colonial West-Africa Railways.*

The staff does not participate in the administration of the medical services, but may express suggestions for improving the working of same.

The female staff benefits by the maternity leaves provided by the law's regulations.

One compensation of 3 or 6 months' salary is allowed to the heirs of the staff deceased on active service.

h) *Franco-Ethiopian Railways.*

Medical services are managed unilaterally. Their budget is included in the working budget.

The free choice is organised according to the limits of the organisation of medical services.

Maternity. — Female staff is only used exceptionally in Africa by the F.E.R.; such special cases are settled by individual decisions according to the regulations of the French Social Security Organisation.

No subvention is paid on the death, except in special cases.

The medical services do not intervene in the prosthesis except as far as injured at work are concerned.

i) *Colonial Railways of Indo-China.*

Medical services are managed unilaterally by the staff management. Their budget is included in the working budget.

The medical fees are paid by the staff when the doctor is not chosen in the medical services of the Administration.

The female staff obtains 2 months of maternity leave. No provisions are made in favour of the wives of workers or retired workers.

A subvention is paid on the death of a worker on active service.

The Administration supplies only prosthesis to the injured on service.

7. Greece.

a) *The State Railways.*

The administration of medical services is effected with the participation of the insured.

The mutual support fund is administered by one administrative council composed of 7 members :

- the director-general of the Railway-system, president;
- 2 officials of the Railway-system, appointed by the Administration;
- 3 representatives selected by the staff;
- 1 state representative.

The budget is fed by a share of 5 % of the salaries, paid by the staff and 7 % for account of the Railway. The retired staff has to pay a double contribution. Gifts and legacies feed the budget too.

The staff has free choice of the nursing homes which have a contract with the mutual support fund.

The female staff enjoys the maternity leave provided by the International Convention of Washington.

The wives of the workers or of the retired are entitled like the female staff, to the medical and hospital attendance.

A subvention for birth equal to 1 month's salary is allowed.

The death subvention is equal to 3 or 4 months' salary plus one subvention for funerals equal to 1 months' salary.

The mutual support fund intervenes in the prosthesis, except teeth prosthesis. The Railway system pays the prosthesis of the injured at work.

b) *Piraeus-Athens-Peloponnesus Railway.*

The medical services are managed unilaterally.

The support fund is administered by one administrative council composed of 8 members :

- the director-general of the company, president;
- 4 members appointed by the board of the company;
- 3 members selected (every two years) by the staff;
- the chief doctor.

The expenses of the medical service are included in the general budget. The retired do not intervene therein.

The mutual support fund is fed by : 3 or 2 % of the salaries paid by the staff, inasmuch as they are commissioned or not, and 5 or 3,3 % of the salaries, paid by the company.

The free choice of doctors exists only as far as the nursing home is concerned.

The female staff obtains a maternity leave of 12 weeks with 2/3 of the salary paid by the company. The confinement expenses are paid, partly by the mutual support fund and partly by the company.

The wives of the workers and retired staff benefit by the same advantages.

In case of death of a worker on duty, the family receives 3 or 4 months' salary, inasmuch as he has less or more than 15 years' service.

The company pays the prosthesis expenses to the injured at work.

8. Hungary

The Hungarian State Railways.

The medical services are managed unilaterally by the Railway-direction.

The social medical service is managed, however, with an ample representation of the staff. The staff delegates are appointed by the organisation representing the staff interests. The pensioned participate therein too.

The budget is based on concrete data of the previous year and the results of experience made in the meanwhile.

The staff and the Railway pay each 6 1/2 % of the salaries.

The staff has free choice only of the chemists.

The female staff obtains a maternity leave of 12 weeks (6 before and 6 after confinement). A financial support for confinement equal to double the salary during twice 6 weeks and a subvention equal to one months' salary, are allowed. There is a nursing subvention too, equal to the food compensation and one layette subvention.

Such advantages are allowed to the wives of the workmen on service or the retired men.

A death subvention is paid too.

Prosthesis appliances are supplied, some by means of one small contribution, others with a participation of 50 %.

9. Italy.

State Railways.

Medical services are managed unilaterally.

Syndicates and pensioned men are represented in the board of the social support institution and in the committee of support of the State Railways.

The expenses relative to the application of the workmen's compensation acts, professional diseases, malaria and such

expenses of social health-insurances for the not entitled staff, are wholly for account of the Administration of the State Railways.

The budget of prevision and support for the State railwaymen is fed by the monthly contributions of the Railway staff and the Railway Administration (each to the extent of 1.3 % of the salaries, i.e. 2.6 %).

The budget of the previous fund in favour of the State Railway staff is fed by contribution of all the railwaymen (1 1/2 % of the salaries).

The staff has free choice of the doctor, except as far as malaria, professional diseases, working accidents, are concerned; in such cases, the staff is obliged to apply to the respective district doctor.

The female staff obtains a maternity leave of 1 month before and of 7 weeks after confinement, when a normal gestation is concerned. When the gestation and confinement are abnormal, the removal is fixed according to necessity. Regarding a simple abortion, one 7 weeks' holiday is allowed.

During such period, the salary for sickness, normally provided is allowed as well as a subvention for confinement of 5000, 4 000 or 3 000 liras.

No subvention for layette or nursing is provided.

The wives of the retired men do not benefit by such advantages.

Subventions are paid on the death of a railwayman on service or pensioned.

Prostheses are allowed to work-injured during their whole life-time.

10. Luxemburg.

The Luxemburg Railways

Medical services are managed unilaterally. Contributions to the support and health fund are paid to the extent of 1/3 by the railways and 2/3 by the staff. The financial service is managed by the Railways.

The staff has free choice of doctors.

The female staff obtains subventions for the midwife or doctor's expenses (530 fr),

the confinement compensation (100 francs), 60 % of the average salary during 10 weeks (4 before and 6 after confinement), 5 francs per day during 183 days, as a nursing subvention, the stay costs in the maternity hospital during 10 days, and eventually the costs for medical intervention, according to the tariff.

Subvention on the death of a worker on active service or a retired worker, is provided.

The intervention in prostheses is that provided by the laws regulations.

11. Norway.

State Railways.

The medical services are managed with the participation of the staff.

There is a special health-insurance fund in each of our regions. The delegates of the staff are appointed by free election. The retired men do not participate therein.

The support funds are fed by the obligatory contributions of the members (from 2 1/2 to 3. 1/44 of the salaries) and by subventions of the Railways and the State (each 2/11th of the subvention) and the municipalities (1/11th). The bounties and subventions must cover the expenses. The surplus must be covered by the staff.

The free choice of doctors is not absolute.

The female staff has a maternity leave of 3 months.

A confinement compensation of 100 crowns is paid by the health-insurance fund to the female staff and the wives of the workmen and retired men.

The health-insurance fund pays a compensation of 400 crowns.

The prosthesis for work-injured are paid by the Administration. As far as others are concerned, one limited intervention is allowed.

12. Netherlands and Colonies.

a) Dutch Railways.

The medical service is managed unilaterally. The support fund is administered by a committee composed of 6 members,

3 of which affiliated to the fund, are appointed in accordance with the staff representation.

The expenses of the medical service are directly supported by the Administration.

The support-fund is fed by :

- the contributions of the affiliated;
- a subvention of the Administration;
- the penalties inflicted on the staff;
- interests, gifts and receipts unexpected.

The contribution of the obligatory insured and that for the family of affiliated on active service are for account of the administration expenses of the support fund.

The contribution is 1 % of the salary for the staff on active service and 1 % of the latest remuneration paid as far as the retired men are concerned. In addition thereto, there are small contributions for the family and the encumbrance.

The patients have free choice between the doctors and chemists appointed by the support fund; they have free choice of the hospital, subject to the approbation of the commission managing the support fund. The work-injured have free choice.

The support fund pays a confinement compensation to the wives of the affiliated.

Compensation is paid on occasion of the death of workmen on service.

The support fund supplies bandages, spectacles, sets of artificial teeth and hearing-appliances.

Prostheses for the work-injured are for account of the National - Health - Insurance Fund.

b) *State Railways of the East-Indies.*

The staff has free choice of doctors, chemists and nursing homes.

The female staff can obtain one maternity leave of 6 months as a maximum.

The prosthesis expenses are partly refunded.

13. Portugal and Colonies.

a) *Portuguese Railway Company.*

Medical services are managed unilaterally.

A maternity leave fixed, by the medical services, is allowed to the female staff. No special subventions are allowed.

Compensation is allowed on the death of railwaymen on active service.

Prostheses are allowed gratis only to the work-injured.

b) *State Railways (Mozambique).*

Medical services are managed unilaterally.

The budget is included in the Administration budget.

The staff has no free choice of the doctor, chemist and nursing home.

The female staff obtains a maternity leave of 2 months with full salary.

The death compensation is only paid, when the railwayman is a member of the « Monte Pio ».

In case of a working accident, the prosthesis is supplied by the Administration.

14. Sweden.

State Railways.

Medical services are managed by the Administration itself.

The budget is included in the general working budget.

The staff is obliged to apply to the nearest Railway doctor, but he has free choice of a chemist.

The female staff benefits by a maternity leave, but does not obtain any other subvention. No advantage is allowed to the railwaymen's wives.

Compensation is paid on the death of a railwayman.

Prostheses are only allowed to the work-injured.

15. Switzerland.

a) *Federal Railways.*

The staff does not intervene in the medical services. Medical questions are treated in an independent manner by the doctors of the medical direction.

The expenses of medical service and sickness unemployment are for account of the exploitation budget.

The staff has free choice of the doctor, chemist and nursing home.

The female staff is treated as a patient on confinement and remunerated accordingly. There is no special compensation.

On the death of a railwayman on service, the salary continues to be paid, during 1 month more, but no compensation is paid on the death of a pensioned man.

The medical service does not intervene in the prostheses for patients. A part of the expenses is refunded by the health-insurance fund of the staff of the C. F. F. to its affiliated.

The prostheses for work-injured are for account of the National Insurance Fund in which the whole staff is insured.

b) *Bernese Alps (Bern-Loetschberg, Simplon) Railways.*

The health insurance fund is managed by a committee under the control of the direction. That committee is composed of 4 members (\pm 4 substitutes) appointed by the direction, the Railway director being the president, and 5 members (\pm 4 substitutes) elected by secret ballot by the affiliated.

The support and pension fund is fed by :

The staff : by means of a contribution of 7 % of the insured remuneration;

by means of a single contribution in case of an increase of the remuneration;

by means of an affiliation right of 5 % on the insured remuneration if the affiliation took place after the age of 25 years.

The Administration : by 8 % of the remuneration by a single contribution of

6 monthly payments for each increase till the age of 45 years;

by a contribution equal to the affiliated fees of the new affiliated.

by the compensation of the contributions of each insured having not been paid in case of sickness;

by a rate of nominal interest of the fund + various small contributions.

The affiliated have free choice of the doctor and the chemist, except where the fund had entered into a special agreement.

Maternity : the female staff is entitled to the attendance and service provided in case of sickness for a duration of 6 weeks + one nursing subvention of 20 francs, inasmuch as the mother feeds her child during 4 weeks more than the above mentioned 6 weeks.

Confinement expenses :

— at home : 80 francs.

— in a nursing home : according to the dispositions of the sick affiliated.

The wives of railwaymen on service or pensioned do not obtain anything.

A subvention is paid on a workmen's death.

Prostheses for patients, except the teeth prostheses, are delivered gratis for account of the health insurance fund. The Federal accident fund settles the question of the prostheses to be allowed to the work-injured.

c) *Emmenthal-Burgdorf-Thun Railway.*

The staff has free choice of the doctor.

A subvention of 100 francs is paid on the death of a worker.

16. Syria.

Damas, Hama and Extensions Railways.

Medical services are managed unilaterally.

The staff allows a deduction of 1 % from their salary, for contribution to the medical service. The Administration bears the extra expenses.

The staff has only free choice as far as the nursing home or hospital is concerned and under the reserve that the staff has to pay the eventual difference, between the tariff of the institution and that of the hospital bound by contract with the Railways.

The female staff benefits by a maternity leave of 40 days, without any other special compensations. No advantage is allowed to the workmen's wives.

A compensation is paid on the death of workmen on active service.

A part of the prostheses expenses is refunded to the patients. The prostheses are supplied gratis to working injured.

17. Turkey.

Turkish Harbours and Railways.

Medical services are managed unilaterally. The right of claim and reclamation by the staff is reserved.

There is no special budget.

The staff has not free choice of the doctor, the chemist and the nursing home.

The female staff obtains a maternity leave of 45 days.

The health insurance fund pays compensation in case of confinement of the wife of temporary railwaymen and not imma-triculated workers.

The Administration pays one month's salary to the female staff or the wife of one finally appointed worker.

The wives of the retired workers obtain no advantage.

On the death of a worker, the Administration pays compensation equal to a salary of two months. The death of a wife entitles the payment of 1 month's salary.

No compensation is paid on the death of a retired man.

The Administration or the security fund intervenes in the prosthesis expenses, according as appointed or temporary railwaymen are concerned.

GROUP 5.

Social.

1. What forms of social activities do staff on your Railway take part?
2. What part does the Railways play in promoting the various social activities?
3. How are your social services administered?

Unilaterally or with the participation of the staff?

In the latter case, on an equal basis or with a reduced representation of the staff?

Give full particulars about the conditions of such a co-administration.

How are the staff delegates chosen, if there are any (free election, nomination by all staff-organisation or only by some of them; in that case what conditions are those associations to fulfill)?

Do the pensioners participate in the administration of social welfare?

4. How is the budget of those social services drawn up?

How is the service's fund financed?

Point out in particular on what basis the administration subsidize the fund and what is the contribution of the staff and of the pensioners separately?

By whom and how are the financial operations being done?

ANSWERS.

1. Austria.

Austrian Federal Railways.

The staff must participate in the various forms of activity of the social insurance. As far as the A. F. R. are concerned, they delegate representatives to the Administration organisms.

The railwaymen's social insurance organisation is administered by 1 committee composed of 18 members: 2/3 of which represent the staff and 1/3, the employers.

The general meeting is composed of 120 representatives divided according to the same proportions. A committee composed of 6 members (always in the same proportions) is legally appointed for controlling the financial management. All the representatives of the insurance organisations are elected among the members of the professional organisation (work community chamber of workmen stewardship).

Provisional payments in advance are made for the accident insurance organisations.

Final contributions are fixed according to the results of the financial year.

As far as the health-insurance organisation is concerned, employers and workmen pay the same contribution and the available funds are invested to bear interest.

2. Belgium and Colony.

a) *Belgian National Railways.*

The staff on active service and pensioned men participate financially and jointly with the company in the constitution of the social work fund.

The staff participates jointly in all the manifestations of national safety and social solidarity.

The Railways allow :

a subvention equal to 3 % of the whole salaries and in addition a compensation equal to the contribution of the staff on active service or retired. They undertake furthermore the expenses for the working of the social work organisation and for the remuneration of the necessary staff.

The social services are managed with the participation of the staff by parity, and by means of a series of national, regional and technical committees. The staff delegates are appointed by entitled organisations to the extent of their members. The budget estimations of the social work organisation are made according to the expenses of the previous financial year and some elements of estimation for the next financial year.

The social service fund is fed by :

a subvention of the Railways equal to 3 % of the whole salaries;

a contribution of the staff equal to about 2 % of the gross salaries, and 8 % of other remunerations;

a contribution of the pensioner men equal to 1 1/2 % of the amount of their pension;

an extra intervention of the Railways equal to the contribution of the railwaymen on service and the pensioned men;

the interests of the investment or various funds and incomes.

The Railways manage the funds and the treasury.

The accounts must be approved by the organisations controlling the funds.

b) *Société Nationale des Chemins de fer Vicinaux.*

A National Parity Committee composed of 14 members appointed by half, by the board of directors and by the syndical staff organisations as well as the regional parity committee, functions in accordance with the law of 1927.

The number of the delegates in the regional committees is determined, as far as each syndical organisation is concerned, by means of elections, where the staff must participate.

The principal social works are :

1) as far as the staff ruled by the social safety organisation is concerned, the fund for distributing subventions to invalids (C.R.I.) and the fund for distribution of extra subventions to be added to the legal pension (C.R.A.).

2) as far as the staff not ruled by the social security organisation is concerned, the health-insurance fund (S.A.M.) and the mixed insurance fund (C.A.M.).

Those organisations are managed by committees of a parity form, composed of 6 membres. Pensioned men intervene only therein for appointing staff delegates in the S.A.M.

A clothing centre for each group of exploitation, functions under the control

of the regional parity committee. There is no regular budget, but there are budget estimations. The treasury is controlled by the company.

Receipts :

C. R. I. : affiliated: 1 %₀₀ of the remuneration:

Company : 3 %₀₀ of the whole remunerations of the affiliated.

C. R. A. : *salaried* : a contribution of 4 1/2 % of the part of remunerations not submitted to the deductions of the social security organisation.

Contribution by the Company : 3 1/2 % of the part of the remunerations submitted to the deductions of the social security organisation and 9 % of the surplus.

Appointed : like the *salaried*.

Contribution by the Company : 3 and 9 %.

S. A. M. : the affiliated and the Company each pay 2,25 % of the part of the remuneration exceeding 4 000 francs per month.

C. A. M. : *affiliated*: 6 % of the remunerations.

Company : 10 %.

Clothing Centre : yearly subvention of the company varying from 625 to 1 200 fr., by each beneficiary railwayman, according to his class.

C) Otraco.

Up to the present, the social service functions only to the benefit of the native staff. That office promotes by all means various social activities. The social services are managed unilaterally by the social staff, voluntary help is owed by members other during their leisure time. The retired men do not participate therein.

All the expenses are for account of the Otraco.

3. Denmark.

State Railways.

The health insurance fund constituted for the permanent staff is financially helped by the Administration either by means of money subventions, rooms or staff.

4. Spain.

Red Nacional

De los Ferrocarriles Españoles.

A council was constituted in the Railways for treating questions of hygiene (as far as workshops, food rations, duration of the working day are concerned).

That council is composed of engineers and further specialists and the chief doctor.

The administration is unilateral. The workmen feed the respective fund (to the extent of 3 % of their salary) as well as the Railways (6 % of the remunerations).

5. Finland.

State Railways

The social activities' aim at the improvement of the economic situation and the development of the physical staff conditions.

The Railways pay subventions for cultural purposes. Such expenses are included in the budget. The general principles of administration are observed as far as the control of such activities is concerned.

6. France. — Algeria and Tunisia, Colonies and Protectorates.

a) French National Railways.

The staff representatives appear in the administrative committees and social activity controlling committees having financial autonomy in the Railway Company and in the central committee of social activities.

The S.N.C.F. aims at promoting and spreading out to the extent of the requirements, the efficiency of the various social activities at the disposal of the staff. It promotes the working and the rational extension of the activities of a social character, created by the staff, by giving its moral support and material assistance to the groups and societies constituted by the railwaymen.

The support fund for retired men is

administered by a control committee, the prevision fund and the stewardship fund are controlled by an administrative committee, constituted by representatives of the S.N.C.F. and the staff under the presidency of one director of the S.N.C.F.. The representatives of the staff are elected either directly or appointed by entitled organisations.

Retired men have representatives in the 2 former organisms and participate in the administration of same.

A central committee of the social activities manages and controls with the general direction and under the chairmanship of the director of the central staff service, the working of the whole social activities of the S.N.C.F. It is constituted by representatives of the S.N.C.F. and of the staff (elected by same).

The staff representatives include the president, the chief of the central direction of the social and medical service, and the chief engineers entrusted with the regional directions and social services. There are 9 staff representatives, 3 of which as section representatives. They are elected by the staff representatives, being self selected by ballot in order to sit in regional committees. Each syndical entitled organisation may appoint one representative who sits with a consulting vote in the committee. Within each direction of a region, a regional committee controlling social activities and president by the region director, is constituted in the same manner.

Each regional committee includes the president, assisted by the chief engineer, and trusted with the social services, one representative for each of the 3 principal services (Working Rollingstock and Traction - Permanent way). There are 7 representatives of the staff, 3 of which as section representatives. The appointments are made as for the central committee.

Each local committee is composed of a small and variable number of representatives of the S.N.C.F. and the staff.

The retired men do not participate in those various committees.

Such committees can constitute commis-

sions specialised in the study of special questions; their reports are submitted to their committees, which decide about the solutions to be given.

The social services of the S.N.C.F. have no special fund. The credits allowed appear with varying headings in the budget of the working costs of the S.N.C.F.

b) *Regie autonome des Transports parisiens.*

The social activities are instituted, either in favour of the staff or their family. They include the groups for youth, sporting groups as well as cultural artistic groups and mutual support groups.

A special budget is fixed each year, in the frame of the law, by the board of directors of the Administration, and put at the disposal of the committee of enterprise, for the administration of the social works.

That committee in accordance with the law :

- manages the social works, which are not incorporated;
- participates in the administration of social works, being incorporated.

The administrative committee of each of those works is composed by half of members of the committee of enterprise — it controls the administration of works of a mutualist character, in which it delegates 2 representatives.

The retired men participate in the administration, when they are admitted to share the benefits.

The board of directors of the Administration fixes the annual amount of the budget. The funds are transferred to the fund of the committee of enterprise.

The intervention of the staff and the pensionned, if allowed, is effected by means of pre-account.

The committee makes furthermore payments to the various social works on service, according to the budget estimations.

c) *Algerian Railways.*

The staff participates in the following social works :

- sending the railwaymen's children to holiday colonies;

— support to be allowed on death — retirement — insurance, subventions for sickness and maternity, support to orphans, dowery compensation for funerals, renewable support, attendance to tuberculous workers, sanatorium expenses, rest houses, renewable support for retired railwaymen — promotion of interests of ex-service men and large families.

The Algerian Railways allow subventions to some societies (orphan-asylums and sanatoriums) and controls directly the social works of « Le Petit Cheminot à la Montagne » (holiday camp for railwaymen's children).

The administration of the social services is effected with a reduced staff representation, elected in the instituted committees. Each trade-union entitled organisation may appoint one representative with consultative vote.

The retired men may intervene therein like the railwaymen on active service.

In the general budget of the Railways exists a special « support » credit, at the disposal of the special services.

d) *Gafsa-Railways.*

The social activities include : mutual support, orphan-asylums, fraternal associations, sanatoriums.

The Railways allow various subventions and support. The staff does not intervene in the administration, but its meaning and remarks are taken into consideration.

All the expenses are for account of the exploitation account.

e) *Compagnie fermière des Chemins de fer tunisiens.*

The staff controls the local sections of the mutualist works, it is busy with tourism, artistic, sporting societies or with holiday camps.

The Railway gives a material and financial assistance.

f) *French Equatorial Africa Railways.*

There is no special social service.

g) *Colonial French West Africa Railways.*

There are cooperative societies, clubs, sporting societies.

The social service is about to be created and the staff delegates may give suggestions, which are examined with great attention.

The Railways allow great material commodities and subventions.

The direction undertakes the administration.

A credit was allowed for the year 1949, by the board of directors (7 800 000 francs).

h) *Franco-Ethiopian Railway.*

The social service constitutes a family group with sporting centres, library, stewardship, destined to be transformed into a cooperative society.

The Railway allows subventions to clubs, supplies rooms and grounds, helps the various groups.

The social questions are settled directly by the direction of the exploitation, which periodically discusses the matters with the staff delegates.

The expenses are included in the exploitation budget.

i) *Colonial Indo-Chinese Railways.*

The social activities in which the staff participates are still limited : assistance committee — library service — stewardships — sporting clubs.

The Railways allow subventions.

The staff participates in the administration : it has as many representatives as the direction (2 members) in the assistance committee, the housing committee, stewardship and leisure of the staff. Such delegates are appointed by means of free elections. The retired men do not participate therein.

The expenses are for account of the working budget. Subventions are allowed to sporting societies, for purchases of books, etc..

The first funds for solidarity have been supplied by means of a subvention of the Administration, the benefits of stewardships and the free contributions of the staff.

j) *Morocco Railways.*

The Railway Company created at its own expenses holiday camps and summer resorts.

7. Greece.

a) *State Railways.*

No regular social activity.

b) *Pyraeus-Athens-Peloponnesus Railway.*

Nothing special to be mentioned thereabout.

8. Hungary.

Hungarian State Railways.

Did not send answers to these questions.

9. Italy.

State Railways.

Social activities : domains of activity :

1) Social assistance : canteens, refectories, children asylums, etc.;

2) Education and culture : libraries, entertainment rooms, professional lectures, etc.;

3) Recreation : plays, gymnasiums, lawn-tennis and sports.

Sanitary assistance : direct assistance by means of sanitary attendance — indirect assistance by refundment of the expenses.

Medical assistance : supplied gratis to the work-injured and professional patients as well as railwaymen and their family suf-

fering from malaria, contracted in the zone of the obligatory residence.

Pension and support funds.

Prevision work for the staff : compensation at the end of services — support to orphans — fund pension to necessitous families — free scholarships — summer colonies — extra subventions — health insurance compensations for too long absent workmen — construction of economic houses — loans — advances of money with short terms.

Interventions of the « ferroviarie dello stato » (F. S.) :

Subventions or contributions :

1) 1 1/2 % of the emoluments for the sanitary assistance (1 billion 200 millions liras per year);

2) 3 % for the social insurance;

3) leisure of the railwaymen (2 millions 700 000 liras);

4) construction of houses, to be let to the staff, wholly for account of the F. S.;

5) All the expenses of the medical assistance to the work-injured, professional and malarious patients (as a consequence of obligatory stays in some regions);

6) Subventions in case of deficits in the pension funds (for the actual financial year : 21 billions of liras);

7) The 9/10th of the expenses for social insurances for the non-entitled staff (1/10th for account of the workers themselves).

The administration has various activities: sanitary assistance, loans, advances of money, supports are controlled directly and unilaterally by the Administration of the F. S. in the administrative committee when the staff is represented by 3 free elected members.

The administration of the economic houses is effected by the Railway Administration. The staff has a reduced representation, selected by the most important syndical organisations, in the commissions of distribution of such houses.

The social prevision work is administered by a committee of 12 members : 1 president, 4 representatives of the F. S., 6 representatives of the staff on service and pensioned, 1 foreign representative. The representatives of the staff are selected by the Minister of Transport on the suggestion of the trade-unions.

Leisure : Direction and control of leisure, effected by special interior organisms of the general direction. Local clubs are administered by organisms, the members of which are elected by the staff.

The general sanitary assistance is administered by administrative organisms, including trade-union representatives.

The budgets are included in the F. S. budget.

Pension funds : deduction of 6 % from the salary and other subventions — subvention for the same amount of the F. S. — extra subventions of the treasury for covering the deficit — interest on the capital of the fund.

The prevision funds : contribution of the staff : 3 % of the salary — an equal subvention by the F. S. — amount of the staff penalties — net benefit of the publicity in Railway stations and trains — small expenses for account of libraries of the Railway stations.

Cultural — educative — recreative assistance : contributions of the staff : 10 liras per month; subventions of the F.S. : 10 liras per annum and per employee a fixed subvention of 800 000 liras.

Economic houses : rents.

10. Luxembourg.

Luxembourg Railways.

The company helps the work of the Luxembourg Red Cross (State) for fighting tuberculosis, cancer, instituting rest cures, sending children to cure houses, etc...

The administration is effected unilaterally by the Railways and for their account.

11. Norway.

State Railways.

The social service is not in operation.

12. Netherlands and Colonies.

Netherlands Railways.

85 % of the entitled staff pay voluntary contributions to the fund for social assistance (created by the railwaymen and quite independent).

Female house keeping assistants (paid by the fund) — Female social assistants (paid by the Railways) — They supply moral and material assistance to the staff, the retired men, the families; free scholarship is allowed to the best endowed children.

The Railways allow, in addition to the remuneration of the female social assistants, a subvention equal to the staff contribution.

The social services, as a general service, are administered unilaterally by the Administration.

The assistance fund is administered with the participation of the staff, which has the half of the mandates.

The social assistance foundation is administered by a committee of members of the staff, 5 members at least, on active service or retired, elected by the general direction.

13. Portugal and Colonies.

a) *Portuguese Railway Company.*

The Railway company gives subventions to the social works and makes same obligatory.

The staff delegates, elected by their organisations are represented in administrative committees of the social works.

The expenses are for account of the exploitation expenses.

b) *State Railways (Mozambique).*

The staff created clubs. The Railways give subventions. The staff and retired

men, if they pay their contribution, participate in the administration. They are appointed by free elections. The Railway system chiefs are the presidents of the committees.

The expenses are for account of the Administration.

14. Sweden.

State Railways.

Trials are made for helping the staff, by an adviser of social questions.

There is no special budget.

15. Switzerland.

a) Federal Railways.

The Railways participate in the administration of the pension and support fund and in the health-insurance-fund.

They allow to the members of those commissions leavers for attending the meetings and sufficient compensation, for covering travelling expenses.

The direction settles in an independent way the questions of a social character.

The staff is represented proportionally to its members, by the mediation of 5 syndical organisms, in a series of commissions, where it can give its opinion.

The expenses of those services are for account of the Railways. In case of sickness the salary is for the working account.

Pension fund : the insured pays a contribution equal to 7 % of his salary and the Railways pay a contribution of 8 %.

The fund is managed by the Railways.

b) Bernese Alp Railways (Bern-Loetschberg-Simplon).

The staff participates in the administration of the pension and support fund and the health-insurance-fund.

The Railways pay subvention to 2 funds and support the administration expenses.

The receipts of the health-insurance-fund are constituted by :

- the premium paid by the affiliated;
- the contribution of the Administration : 1 % of the salaries;
- the federal contributions;
- the share of the affiliated in the medical expenses (10-25 %).

The surplus are paid to a support fund and the deficits are covered by such fund and, by default, by the Administration.

c) Emmental-Burgdorf-Thun Railways.

No answer.

16. Syria.

Damas, Hama and Extension Railways.

No answer.

17. Turkey.

Turkish State Railways and Harbours.

The staff participates in social activities, which are not legally obligatory.

Two distinct companies supply support, in case of retirement or death.

The Railways participate in the measures in accordance with the law's prescriptions. They promote the organisation of consumer cooperative societies.

The obligatory activities are managed unilaterally; the facultative ones must comply with the law's regulations and the statutes are submitted to the approval of the Administration.

There is neither budget nor special fund.

The expenses are for the working account.

GROUP 6.

Entertainments.

1. *Are clubs, musical and dramatic societies and holiday camps provided by the railway for the benefit of staff free of cost*

2. *How are these organized and administered?*
3. *To what extent do staff and Railway control the running of these institutions?*
4. *Is membership of these institutions compulsory or optional?*
5. *How are these financed and what annual amount is set apart for this purpose?*
6. *Are the initial equipments and maintenance provided free of cost?*
7. *What is the average membership of these institutions and what is the average regular attendance?*
8. *Are free travelling facilities given to staff when they are off duty and dependent members to attend functions arranged by these institutions?*
9. *Are entertainments for example dancing, music, pictures arranged at frequent intervals in these institutions?*
10. *If the answer to the above is in the affirmative, how is the expenditure met?*
11. *Is there a bar or canteen attached to each of these institutions and are refreshments supplied at reduced prices?*
12. *Are any educational instructions for instance facilities to learn languages, useful hobbies given for the benefit of staff in these institutions?*
13. *Are members of the family of railwaymen, retired employees and dependent family members of railwaymen, permitted to attend these institutions? What are terms and conditions?*

ANSWERS.

1. Austria.

Federal Austrian Railways.

There is actually nothing of that kind.

2. Belgium and Colony.

a) *Belgian National Railways.*

There are clubs and artistic, dramatic, musical and touring societies, created by the staff. These are autonomous and independent institutions controlled by their affiliated, the cooperation of which is required sometimes by the Railway. The affiliation is facultative.

Those organisations are financed by the contributions of the members and the receipts of performances, tournaments, etc.

The fund of the social works can allow subventions on the decision of the national sub-committee of the social solidarity.

The artistic, dramatic and musical institutions have about 2 150 members.

The affiliated of the touring associations are about 23 000.

No extra facilities of transport are allowed to the participants, except on the occasion of some important national matches or international matches. Such facilities are reserved to the active participants and officials.

Each organisation or institution draws up the programs ad libitum and bears the expenses thereof. There is no bar or canteens in such institutions. There exists no educative organisation relative to those institutions.

The members of the railwaymen's families, the pensioned and their families can be affiliated in those institutions, on conditions fixed by each of them « ad libitum ».

b) *Société Nationale des Chemins de fer Vicinaux*

The company is not concerned in the leisure of the staff.

c) *Otraco.*

In each important centre, there exist meeting places at the disposal of the railwaymen and their family. There are games and recreative clubs. Study parties, thea-

trical and cinema performances, etc., are organised there.

Those centres are administered by committees elected by natives, but controlled by one supervision committee composed of Europeans.

Travelling facilities are allowed to the staff participating to these entertainments.

Musical, dancing or cinema parties are organised at the expenses of the Otraco.

Bars or canteens sell consumer products at cost price. There exists likewise an education organisation for the staff. The wives and daughters of the workmen can benefit thereby.

3. Denmark.

State Railways.

There is a holiday camp reserved to the railwaymen and their family, against payment of the food.

This camp is kept by a manager who fixes the costs and conditions of the stay according to a contract.

The syndicates control to a high extent the exploitation of the resort.

4. Spain.

Red Nacional de los Ferrocarriles Españoles.

No answer.

5. Finland.

State Railways.

There are musical and study clubs, societies of various objects, holiday resorts, the whole being organised and managed by the staff, whose affiliation is facultative.

They are financed by means of the contributions of the affiliated and the subventions of the Railways.

The first equipment and the maintenance are not supplied gratis.

Those societies and clubs have a variable importance.

The participants benefit by travelling facilities.

Entertainments (musical, dancing and cinema performances, etc.) are organised.

The expenses thereof are covered by the staff contributions.

No bars or canteens.

There exists an educative organisation which the families may benefit by.

6. France. — Algeria and Tunisia, Colonies and Protectorates.

a) *French National Railways.*

There are societies organised by the staff for the entertainments of the families. They are wholly managed and controlled by the staff. Such societies are grouped in three important associations : the sporting union of the French railwaymen, the artistic and intellectual union of the Railways and the touring association of the railwaymen. This last association organises holiday camps for young adolescents, with the assistance of the social services of the S.N.C.F. and the participation of the beneficiaries. These camps complete in a happy way the holiday periods of children, who are received in camps, hostels and resorts organised by the subdivision of the youth education of the regional social services. There are received each year about 25 000 children of 4 to 16 years of age.

The working of facilities created and administered by the staff, is controlled by the central committee and the regional committees of the social activities, which appoint respectively two representatives, viz. one of the S.N.C.F. and one of the staff, in order to sit in their directive organisms.

The affiliation is quite facultative.

The principal resources are supplied by contributions paid by the members. The S.N.C.F. allows yearly subventions estimated in proportion of their activity and requirements.

The equipment and maintenance expenses are for account of the interested societies, but a subvention called « a starting subvention » can make easier the starting of such societies.

The approximate number of the members is 52 000 for the « sporting union », 44 000 for the « artistic union » and 80 000 for the « touring association ».

Some travelling commodities are allowed in a limited number and subject to some conditions.

The organisation of entertainments depends on the initiative and means of the societies and groups created and managed by the staff. The S.N.C.F. does not intervene therein.

The organising society aims at covering the expenses involved.

The eventual opening of a bar or canteen can only succeed when resulting from the initiative of the organising societies, which fix the financial terms and the working conditions thereof.

Educative lectures and courses are organised specially in the societies grouped in the artistic and intellectual union of the Railways.

The retired men and their families benefit by those various institutions on conditions usually similar to those fixed for the railwaymen themselves.

b) *Régie Autonome des Transports parisiens.*

There exist artistic and cultural groups + 4 rest-resorts for the railwaymen and their families (price per day in 1949 : 375 francs).

The essential principle of the administration is that the receipts must cover all the seasonal expenses. A manager is responsible of each centre.

Delegates of the committee of enterprise control the good working of those organisations, on the occasion of unexpected visits.

The affiliation is facultative.

The season receipts cover in principle the season expenses. The annual expenses are for the committee of enterprise.

There was ascribed for 1948 :

— to the cultural and artistic organisations : 9 1/2 millions;

— to the rest resorts : 23 millions.

The first equipment and its maintenance are included in the budget.

The cultural and artistic organisations had more than 5 000 affiliated in 1948. There were about 1 000 beneficiaries of rest-resorts.

The staff of the R.T.A.P. benefit by a transport card on the lines of the rail and road system of that Administration. As far as removals in provincial places are concerned, the social group concerned intervenes in the expenses.

The rest resorts are equipped with wireless sets. When this is possible, cinema performances are organised. The expenses resulting therefrom are for the budget of social works.

A bar is installed in the rest resorts. Educative concerts, conferences, museum visits, exhibitions and libraries are regularly organised.

Retired men and their family benefit by those institutions on the same conditions as the staff on service.

c) *Algerian Railways.*

There exist an artistic painting society and a central library in Algiers, as well as musical societies and a touring association. In summer holiday camps for railwaymen's children are organised. Such societies are managed by the railwaymen themselves.

d) *Gafsa Railways.*

There are 2 sporting clubs, wholly managed by the staff. The autonomy of these institutions is complete. They receive some rare subventions and a direct material assistance (workmanship, materials, etc.).

Travelling facilities are granted.

Entertainments and special cinema performances are organised. The expenses thereof are covered by the receipts. The entertainment room has a bar.

There is no educative organisation in those institutions.

e) *Compagnie fermière
des Chemins de fer tunisiens.*

There exist an artistic and intellectual group and a touring society. A holiday camp, not gratuitous, is organised every summer in favour of the railwaymen's children. That camp alone is managed and controlled by the services of the Railway system.

The affiliation of the staff is facultative.

There is no special budget. The company allows subventions to artistic and touring societies. The camp receives various subventions and parents pay a fixed amount for the children admitted therein.

A part of the products of the entertainments organised by the mutualist societies of the staff, is paid to the fund. The company bears the surplus of the expenses.

The question of extra travelling facilities is not yet considered.

No further entertainments are provided. The various institutions are opened to the retired men and the families.

f) *French Equatorial African Railways.*

No similar institution is considered.

g) *French Colonial West African Railways.*

There is a club with meeting room, library, tennis courts. A good restaurant is annexed where meals and beverages are served.

h) *Franco-Ethiopian Railways.*

There are sporting and family associations, a library, the whole organised and managed by the staff alone, without intervention of the Railway,

The affiliation is facultative. The associations fix the amount of admission fees and the yearly contribution.

The company allows supplies, works subventions.

The library is for account of the company, which undertakes likewise, the first equipment and extra work on sporting grounds.

The number of the affiliated is variable.

The usual travelling facilities are sufficient.

Entertainments are organised from time to time, the expenses of which are covered by the groups concerned. There is neither a bar nor canteen in those institutions.

i) *Colonial Indo-Chinese Railways.*

There are sporting societies managed by the social service with the staff participation. The affiliation is facultative. They are financed by contributions.

The first equipment is effected gratis by the sporting societies.

105 agents are affiliated. They obtain special travelling facilities.

No special entertainments are organised and there is no special educative organisation.

j) *Morocco Railways.*

There are holiday camps and summer resorts, organised and managed by the Railways. The beneficiaries thereof pay a small contribution.

7. Greece.

a) *State Railways.*

There is a railwaymen's club, open to all railwaymen and a musical, sporting association among the railwaymen of the North region. Those organisations are independent from the Administration and are managed by commissions of staff supervision. The affiliation is facultative.

They are financed by the payment of an

affiliation right and the subventions of the Railway.

The installations, if possible, are put at their disposal by the Railways.

The railwaymen's club has about 1 050 members and the sporting association, \pm 200 members.

Travelling facilities are granted.

Entertainments are organised, viz. conferences, trips, visits to industrial concerns, travel abroad. The participants pay their share in the expenses.

There is a canteen-bar selling at reduced prices.

There exist language and music classes, conferences, visits, etc.

The retired men enjoy the same rights as the railwaymen on active service. The members of their family pay only a small contribution.

b) *Piraeus-Athene-Peloponesus Railway.*

The railwaymen have organised a club to which the Railway allows some subventions.

8. Hungary.

The Hungarian State Railways.

No answer.

9. Italy.

State Railways.

There exist educative, cultural and recreative associations grouped under the heading : « The Railwaymen's leisures ». A central office depending on the general direction of the F.S., controls such organisations. The rooms are managed directly or by contract. In the first case, railwaymen are proposed under the joint control of the Administration and the supervision council of the leisures, and they are appointed by elections. In the second case, the concessionary administers in an autonomous way, with his staff, but under the control of the « leisures ».

The members of the syndical college, appointed by elections, control the working of those institutions.

The affiliation is facultative. The staff pays a yearly contribution for affiliation and a extra contribution for each activity.

The Administration allows a yearly subvention of 800 000 liras + 10 liras per annum and per each member.

The first equipment and maintenance are supplied gratis. 120 000 railwaymen are affiliated; 70 % participate in the activity.

Entertainments are organised periodically, after the working hours and in special rooms. The expenses are covered mainly by the receipts and, if necessary, by contributions of the « leisures » or the administration of the F.S. In most rooms is a bar or a canteen with drinks sold at reduced prices.

Educative lectures are organised.

Such institutions are opened to the retired men and their families.

10. Luxemburg.

Luxemburg Railways.

There is a musical society of the Railways (harmonie), created in 1945. It is administered by a committee composed of railwaymen and controlled by the staff. The affiliation is facultative. It is financed by subventions of the Railways and contributions of the members.

The first equipment and the maintenance are gratuitous.

There are about 3 000 members, 75 of which are active members. Travelling facilities are allowed.

Concerts and family music performances are organised. The expenses are covered by contributions, the receipts and the subventions of the Railways.

Lectures of music and rehearsals for executants are organised, under the direction of one music master, who is a railwayman.

The retired men and their families can be affiliated therein, like railwaymen on service.

11. Norway.*State Railways.*

No answer.

12. Netherlands and Colonies.*a) Netherlands Railways.*

There are about 60 societies affiliated in one or many organisations :

Union of sporting associations of the Netherlands railwaymen.

Union of recreative associations of the Netherlands railwaymen.

National travelling associations of the Netherlands railwaymen.

They are managed by the staff, with exclusion of the Administration. The railways constituted however a board entrusted with promoting the activity of the staff societies. The 3 national organisations are officially represented therein.

The affiliation is facultative. Such organisations are financed by the contributions of the members.

The Administration allows a small subvention on the establishment of one association. When it is possible, recreation rooms and sporting grounds are installed. Sometimes a part of the rent price is refunded.

The Administration allows advances of money, without interest to important institutions.

There are about 10 000 members registered therein.

6 extra free passes are allowed per year, on the occasion of match meetings.

Various entertainments are organised, the expenses of which are covered by the societies or by receipts.

Educative parties are organised sometimes by some societies.

The railwaymen and their wives can be registered therein. In some associations, retired men and their families are admitted too.

b) East-Indies State Railways.

There exist sporting clubs. The equipment is partly gratuitous.

13. Portugal and Colonies.*a) Portuguese Railway Company.*

There exist an artistic and musical society, sporting clubs and holiday camps at the sea-side or on mountains.

The artistic society is administered by its own committee and the vacancy resorts are administered by delegates of the Railways.

The affiliation is facultative.

The artistic society is financed by means of the members' contributions and the company. The holiday camps expenses are for account of the assistance budget of the company. The first equipment and the maintenance are gratuitous. Travelling facilities are allowed.

Entertainments are organised by the artistic society.

The expenses are covered by the contributions of the members and the subventions of the Railways.

There is neither bar nor canteen.

There exists an educative organisation.

The retired men and their families are admitted without restrictions.

b) State Railways (Mozambique).

There are artistic, literary and musical clubs, managed by staff committees. The statutes prohibit any political activity. The affiliation is facultative and each club has its own budget. Subventions are allowed by the Administration as well as the first equipment.

On principle, travelling facilities are granted.

There are entertainments, the expenses of which are covered by the budget.

There are no bars nor canteens.

The retired men and their families are admitted.

14. Sweden.*State Railways.*

There are no entertainments organised for the benefit of the staff.

15. Switzerland.

Federal Railways.

There exist 40 sporting societies and as many music and choral societies; small conferences are organised by the trade-unions.

There are no holiday camps.

These societies are managed like private societies.

The Federal Railways allow yearly subventions and assist the staff by means of holidays or free-passes, without intervening in the activity of such societies.

The C.F.F. take cognizance of the yearly reports, they are represented in the meetings, but do not intervene therein.

The affiliation is facultative. The receipts come from the contributions of the members and, to a small extent, by the subventions of the Federal Railways.

The first equipment is not gratuitous.

There are 38 000 railwaymen, 4 000 of which are members of sporting societies and 1 100 of music and choral societies. 50 % of such members play an active part therein.

The committees and the delegates to the plenary meetings receive extra holidays and free passes.

The societies organise evening-parties in variable periods and the expenses thereof are covered by the receipts. On the occasion of anniversary feast of the societies, the F. R. are represented and allow gifts of money.

There are no bars and canteens.

The staff associations organise instruction lectures, but without the Railway participation.

b) *Bernese Alps-Railways*
(*Bern-Loetschberg-Simplon*).

No answer.

c) *Emmental-Burgdorf-Thun Railways.*

There are no staff leisure organisations.

16. Syria.

Damas-Hama and Extension Railways.

There is a sporting association managed by railwaymen elected by the staff. The Railways have no intervention therein.

The affiliation is facultative. That association is financed by means of the staff contributions, the receipts of the sport meetings and the subvention of the Railways.

Travelling facilities are allowed. No entertainments are organised and there are no bars or canteens.

There is no educative organisation.

17. Turkey.

Turkish State Railways and Harbours.

There are sporting clubs, each including a reading room and a small library. A central library possessing 16 000 books loans same gratuitously.

The whole direction is assumed by an administrative committee, whose president is appointed by the general direction. The Administration has the exclusive control of the good working.

The affiliation is facultative. The expenses thereof are covered by contributions of the members and a yearly subvention of the Railways.

The first equipment is supplied gratuitously. Most railwaymen are affiliated, but 10 % thereof participate therein actively.

The members, who participate in competitions organised by the department of education, enjoy a gratuitous voyage.

The sporting clubs organise sometimes musical, dancing reunions and cinema performances, the expenses of which are covered by the participants.

Bars or canteens supply non-alcoholic beverages and small meals at cost prices.

There is no educative organisation in such institutions.

The retired men and their families are admitted without restrictions, but they are not allowed to participate in the competitions.

GROUP 7.

Sports. — Physical culture.

1. *What facilities are provided for staff to take part in outdoor sports and indoor games?*
2. *What type of sports and games are encouraged?*
3. *Are equipments provided free of cost and staff allowed to take part in sports and games without paying any subscription or contributing any sum in running these activities?*
4. *In order to encourage staff, are Railway tournaments conducted?*
If so, what is the organisation and how is the expenditure met?
5. *Does your staff participate to international competitions or between various Railways?*
6. *Are staff given special leave facilities and free travel while taking part in tournaments and athletics organised by Railways?*
7. *To what extent do staff run these institutions?*
8. *How are these financed and what annual amount is set apart for these purposes?*

ANSWERS.

1. Austria.*Federal Austrian Railways.*

The Federal Railways are creating sporting installations, supply gratuitously occupied houses, let grounds and houses and restore installations.

The sporting associations organise their manifestations independently.

The members thereof pay a monthly contribution.

The equipment is not supplied gratuitously.

The railwaymen participate with their sections in the general national championships. The expenses thereof are covered by the associations by means of their incomes.

The staff participates in international competitions, the realisation of which is specially favoured by the existence of the U. S. I. C.

Travelling and leave facilities are allowed for specially important or international events.

The sporting associations constitute local committees of work and each association delegates a representative to the respective committee. There is furthermore a sporting council for the whole federal territory, in which there participate delegates of working committees and representatives of the Administration and the work community of the railwaymen.

The sporting societies are financed by the members' contributions, receipts of sporting performances, subventions and gifts.

2. Belgium and Colony.*a) Belgian National Railways.*

No special facility is allowed to the sporting railwaymen, but all kinds of manifestations are promoted. The affiliated pay a subscription fee. The equipment is not free.

Tournaments are organised by a central committee and the yearly deficit is covered by the social service fund. The staff participates in international or special competitions (specially under the sign of the U.S.I.C.).

Leave and travelling facilities are allowed.

The staff itself organises such sporting institutions.

They are financed by means of the members' contributions and the receipts of the sporting manifestations.

The social work fund may furthermore allow some subventions.

b) Société Nationale des Chemins de fer Vicinaux.

No answer.

c) *Otraco.*

Commodities are allowed in particular travelling and leave facilities, in proportion to the good working of the Otraco.

The natives have a notable preference for football performances.

Equipment and material are supplied free.

Tournaments are organised, the expenses of which are paid by Otraco.

Some European staff participates, benevolently, in competitions.

All expenses thereof are for the Otraco.

3. Denmark.*State Railways.*

Holidays and free passes are granted to some extent.

Following activities are promoted : football, swimming, shooting orientation, ski, physical education.

Railways allow a subvention to the sporting society constituted by the staff : 2 000 crowns in 1947-48, 1 000 crowns in 1948-49.

No tournaments are organised.

The staff participates in international or inter-railways competitions.

4. Spain.*Red Nacional
de los Ferrocarriles Españoles.*

No answer.

5. Finland.*State Railways.*

Free voyages are allowed to participants and officials, as well as holiday commodities.

All sporting manifestations are promoted, specially, wrestling, boxing, football.

Equipment is supplied partially and no inscription fee is imposed. Tournaments

are organised by the staff who participate too in international or inter-railway competitions.

The sporting budget is financed by the Railways.

**6. France. — Algeria and Tunisia,
Colonies and Protectorates.**a) *French National Railways.*

Exceptional leave and free-passes are granted when particular events are concerned.

All manifestations, which promote the sporting training, are favoured and promoted. The sporting union of the French railwaymen is entrusted with the organisation. The S.N.C.F. lends gratuitously installations to the staff and their children.

Each sporting society fixes and decides about its participation in the equipment expenses.

The sporting union and the local friendly societies organise competitions and tournaments. The expenses thereof are for account of such groups, which have to find the necessary resources.

The staff participates in international competitions — the teams are selected by the sporting union. Latter is a member of the U.S.I.C. of which it assumes the presidency.

The staff participates in and administers itself its sporting societies. The resources are fed by the contributions of the members, receipts of competitions and subventions of the S.N.C.F. in proportion to the activity and requirements of such societies.

b) *Régie Autonome
des Transports parisiens.*

The Administration allows, if necessary, a removal or a lightening of the services, a rest removal.

All the sports are practised in the 42 sections of the metropolitan sporting union of the Parisian transports.

The equipment is supplied, in principle, gratuitously by the sporting union. A

subscription fee is paid with a yearly contribution of 400 francs for the active members, 500 francs for the honorary members; children from 6 to 14 years of age do not pay contributions, those from 14 to 20 years of age, pay 200 francs per year.

Tournaments are organised periodically in all the exerted sports. The expenses thereof are for account of the sporting union. The staff participates in international or inter-railway competitions.

7 of the 16 members of the board of the directors of the sporting union are appointed by the committee of enterprise.

The sporting institutions are financed :

- 1) by the members' contributions;
- 2) by funds paid by the committee of enterprise (in 1948, 61 millions were subscribed to the sporting union).

c) *Algerian Railways.*

The Railways allow service facilities and, if necessary, extra-holidays, with salary, for regional and inter-regional competitions organised by the Railways for international matches and challenges of the sporting union of the French railwaymen. Such advantages are reserved to the active participants and to officials whose presence is indispensable.

Sporting societies are administered, exclusively, by staff members.

d) *Gafsa Railways.*

Two sporting grounds and one swimming pool have been recently installed, for account almost exclusive of the Railways.

The equipment is not supplied gratis. Tournaments are organised and the staff participates likewise in international and inter-railway competitions.

Travelling and holiday facilities are allowed.

The direction of the Railway does not intervene in the organisation of sporting institutions, which are managed by the staff and have as far as possible an autonomous budget.

e) *Compagnie fermière des Chemins de fer tunisiens.*

In case of sporting competitions exemptions are allowed to the participants, inasmuch as the requirements of service enables this.

Abstraction therefrom, the sports are held after service hours.

All the sports are promoted. The equipment is not supplied gratis.

Competitions are organised with similar societies of the country.

The railwaymen did not participate yet in international or inter-railway competitions.

The sporting societies of the Railway are administered by the staff.

The resources come from members' contributions, the receipts of entertainments, of one « buvette » and some subventions.

f) *French Equatorial African Railways.*

There is only a football society, which receives a subvention from the Railways (20 000 francs in 1949). That society is administered exclusively by the staff.

g) *Colonial French West African Railways.*

Football, basket ball and athletic sports are exerted.

Material commodities and subventions are allowed by the Railway Company. The sporting societies are administered by the staff. The Railway Company allows a subvention (370 000 francs in 1949).

h) *Franco-Ethiopian Railways.*

No special commodities are allowed for the exercise of sports, as the need was not felt till now.

The members pay contributions and have to pay their equipment.

Tournaments are organised, for account of the groups. No participation in international competitions.

The staff administers itself its sporting institutions, which are financed by the yearly contributions and admission fees.

i) *Indo-Chinese Colonial Railways.*

Since 1945 only some football societies function. They supply gratis the first equipment and receive a contribution.

Inside tournaments are organised and the societies participate in matches inside Indo-China.

Travelling and holiday facilities are allowed. The staff administers itself its sporting societies.

A yearly subvention of 20 000 piastres, or 340 000 francs is allowed actually.

7. Greece.

a) *State Railways.*

Travelling and holiday facilities are allowed.

All sporting or physical culture manifestations are promoted.

The equipment is not gratuitous. The staff pays a contribution and an admission fee. The Administration allows a subvention.

Tournaments are organised. The expenses thereof are covered by the participants.

Actually the staff does not participate in international competitions. The sporting societies are organised by the staff.

b) *Piraeus-Athens-Peloponnesus Railway.*

Nothing was contemplated in that matter.

8. Hungary.

Hungarian State Railways.

No answer.

9. Italy.

State Railways.

The Railways intervene in the expenses

borne by athletes for participating in the competitions (total refundment for important manifestations).

They contribute likewise to the expenses of the first equipment, allow gratuitous transport or 50 % reductions thereof, assistance to the sportmen (medical attendance and training assistance) and the health — insurance and accident — insurance).

All sports are promoted, which many railwaymen are interested in.

The staff pays a small participating contribution.

Tournaments are organised by the staff and the expenses thereof are covered by the receipts or by the free intervention of the managers, and sometimes by subventions of the central office.

The staff participates often in international competitions, as it is affiliated in the U.S.I.C.

Local clubs are managed by committees, whose members are elected by the staff.

The sports are financed by the yearly contribution of the F. S. by the mediation of the central office of the « Leisures ».

10. Luxemburg.

Luxemburg Railways.

The apprentices receive a physical formation given by a monitor.

The equipment is supplied by the Railways.

Travelling and holiday facilities are allowed.

11. Norway.

State Railways.

Extra holidays are sometimes allowed.

There is no sport more specially favoured.

The equipment is not allowed gratuitously.

Tournaments are not organised, but the

staff participates to a certain extent in international competitions.

The staff is not affiliated in the U.S.I.C.

12. Netherlands and Colonies.

a) *Netherlands Railways.*

The following sports are practised : football, table-tennis, swimming, billard, tennis, athleticism.

The equipment is not supplied gratis. A subscription fee is usually imposed.

Tournaments are organised and the expenses thereof are covered by the subscription fees and the members contributions.

There are amicable matches with the Belgian, Swiss and Sweedish railwaymen.

The affiliation in the U. S. I. C. was decided recently.

Special travelling and holiday facilities are not allowed by the Railway. The N.R. do not organise tournaments and sporting meetings.

The organisation is wholly assumed by the staff. The sports are financed by the members' contributions and the partial refundment of the expenses of ground and room hire.

b) *West Indies-State Railways.*

The sporting clubs are allowed a partly gratuitous equipment. They play football, tennis, etc.

13. Portugal and Colonies.

a) *Portuguese Railways Company.*

The company allows exemptions from service, without salary deduction, and travelling facilities.

Football and rowing sports are practised.

Tournaments are organised and the expenses thereof are covered by the clubs and the company.

The staff does not participate in international or inter-railways competitions.

The sporting societies are financed by the members' contributions and the subventions of the company.

b) *State Railways (Mozambique).*

Football, basket-ball, shooting, athletics and cycling are practised.

The railwaymen pay a yearly contribution.

Tournaments are organised and the expenses thereof are for account of the club budgets.

The staff participates furthermore in international and inter-railway competitions. Travelling and holiday facilities are allowed.

The staff participates in the administration of its committees. The sporting societies are financed by the receipts, the members' contributions and the subventions.

14. Sweden.

State Railways.

The sporting society receives a yearly subvention from the Administration. Almost all sports are practised.

The equipment is not supplied gratis.

The members pay a contribution.

The organisation does not organise tournaments, but the staff sometimes participates in international tournaments.

The sporting society is affiliated to the U.S.I.C.

Extra free-passes are sometimes allowed.

15. Switzerland.

a) *Federal Railways.*

The Railways do not allow special facilities, excepted the free travelling and the holidays necessary to the organising committee.

A great manifestation is organised each year : ski, football, athleticism, shooting.

The equipment is not supplied gratis.

An admission fee to the sporting manifestations is required.

The sporting societies organise tournaments, the expenses of which are covered by the staff.

The C.F.F. allow to the sporting railwaymen union, grouping about 40 sections, a yearly subvention of 5 000 Swiss francs. The members' contributions are to be added thereto.

b) *Bernese Alps Railways*
(*Bern-Loetschberg-Simplon Railways*).

No answer.

c) *Emmenthal-Burgdorf-Thun Railways*.

Football, shooting, ski and alpinism are practised.

The Administration does not intervene in the management and the expenses, but allows travelling and holiday facilities.

16. Syria.

Damas-Hama and Extensions Railways.

The Administration participates in the sporting association.

Football, volley-ball, tennis, basket-ball and swimming are practised.

The staff pays a small contribution.

No tournaments are organised and the staff does not participate in international competitions.

Holiday and travelling facilities are allowed.

17. Turkey.

Turkish State Railways and Harbours.

Administrations are obliged by the law to organise sporting institutions. Athletics, shooting, swimming and swimming sports are practised, as well as football, ski, wrestling, fencing and tennis.

The equipment is supplied gratis. The staff participates in competitions organised

by sporting federations. The expenses thereof are covered by such federations or by the receipts. The staff participates likewise in international competitions.

Travelling and holiday facilities are allowed within the limits of the regulations.

The sporting societies are financed by means of a small contribution of the staff and a yearly subvention.

The budget amounts to \pm 80 000 Turkish ponds per annum.

GROUP 8.

Education.

1. *Are professional training schools provided for the staff to improve their position?*
2. *Are dependent members of the staff admitted to these institutions also?*
3. *What is the organisation and what is the budget?*
How is the expenditure met?
4. *Is any subscription compulsory or voluntary collected to run these institutions?*
5. *To what extent staff participate in the running of these institutions?*
6. *Are any special educational facilities provided for the dependent members of the Railway staff at places where there is a general lack of schools?*
7. *What are the facilities given such as free travel, attendant guardian passes, educational allowance, etc., to the dependent members of railway staff?*

ANSWERS.

1. Austria.

Federal Austrian Railways.

Professional education is organised in favour of the staff, with exclusion of the encumbrances. It is organised in accordance with the directions and schemes of the general direction.

The Federal Railways dispose of permanent teachers, completed if necessary by specialised staff.

The expenses thereof are covered by means of funds provided in the budget. The lectures are free.

The selection of programs, the repartition of the railwaymen in the lectures is effected in accordance with the staff representatives.

2. Belgium and Colony.

Belgian National Railways.

There exist professional education and apprenticeship schools for forming professional workmen; there is a school for forming electromechanics and schools for telegram-bearers (for forming railway-clerks).

The staff encumbrance is not admitted therein.

The professional education, apprenticeship and schools are under the control of the National committee of social works, helped by a consultative council of the parity form, called the technical committee of professional education.

Education is given in 4 schools controlled each by a higher official. The lectures are given orally or by correspondence and are sanctioned by delivery of a study certificate. The duration of the apprenticeship or the school attendance is 3 years.

The yearly budget, which varies according to the number of students is on an average 8 millions for the professional education and 12 millions for the apprenticeship schools and training schools. There are no subscription fees.

The recognized organisations of the staff are represented in a parity way in the various committees. They discuss the organisation of the lectures, the elaboration of programs and concordance of aims.

The only advantage consists in some priorities and increases of marks to the students for the admission in the professional and apprenticeship schools.

A 50 % reduction is allowed on the school-tickets to children and orphans of railwaymen on active service, pensioned or deceased men, as well as to the members of family being an encumbrance (not married and till 28 of age).

Free scholarships are not yet allowed, but the social assistance intervenes in interesting cases, by means of subventions or honour loans.

No travelling facilities are allowed to persons accompanying the children.

b) *Société Nationale des Chemins de fer Vicinaux.*

There is a professional education system by correspondence for the railwaymen, with exclusion of their encumbrance. The expenses thereof are for account of the Administration. No subscription fee is paid.

The staff may make suggestion about such education.

There are no commodities for the encumbrance.

The children of railwaymen on active service or pensioned men obtain a reduction of 50 % on school-tickets.

c) *Otraco.*

A professional education is organised in favour of the coloured staff, with exception of their encumbrance. All the expenses thereof are for account of the Otraco. No subscription fee is paid.

The question of free scholarship, travelling facilities, etc., will be considered in due course.

3. Denmark.

State Railways.

There is no professional education.

4. Spain.

Red Nacional de los Ferrocarriles Españoles.

No answer.

5. Finland.

State Railways.

The professional education is organised in favour of the staff.

Their encumbrance is not admitted. The expenses are calculated in the Railway budget. No subscription fee is received.

The staff can make suggestions about the education questions.

The railwaymen's children attending the school obtain free passes available for half-year at a time.

6. France. — Algeria and Tunisia, Colonies and Protectorates.

a) French National Railways.

A varied and as complete as possible professional education is organised for the staff, in order to enable the railwaymen to fill their post with efficiency, to hold offices corresponding to their ability and benefit by promotions.

Such education comprises :

for adolescents : the apprenticeship matters, as well as matters of professional training and general education;

for adults : lectures of professional, adaptive and preparatory matters for examinations of improvement, as well as lectures of general culture.

Railwaymen's children may be admitted in the apprenticeship schools.

The education is given under various form : in a course of training lectures of a variable duration, organised in centres of specialised training for each of the 3 principal technical services; in a course of lectures and conferences held in the services, and by means of works, studies and exercises given directly or by correspondence.

The various programs are drafted by the respective technical services and approved by the central service of the staff. Such service directs and determines with accuracy the pedagogic methods and their application and the formation of the teachers. The professional formation is conceived both as a selection and a direction.

The education is didactic and practical at the same time.

The total budget for the year 1950 is about 2 billions francs and refers to 460 000 railwaymen and 6 000 apprentices. Owing to such efforts the S.N.C.F. is exempted from the payment of the apprenticeship tax, which feeds the general budget of the public technic education.

No fees or contributions are paid.

The staff does not participate directly in the organisation and the working of the professional education. Since 1946 a mixed committee specialised in the matter controls the working and the activity of the apprenticeship.

Subventions and honour loans for study expenses may be allowed to railwaymen's children who attend lectures of secondary or superior technical education. Some rules determine the amount of such subventions which may not exceed a fixed sum and may be applied only to the secondary or superior education. Subventions are only allowed for private education if it is proved that a railwayman's child cannot profit by gratis public education institution of the State.

To the subventions can be added honour loans.

In addition to the commodities in school studies, various lectures are organised by special services or groups of railwaymen, f. i. the artistic and intellectual union of the railwaymen. Household training, the exercise of arts and the practice of physical education and sporting games are developed there.

Normal travelling facilities allowed till 21 years of age may be extended till the end of scholarship (28 years of age and more). School-travelling tickets for gratuitous voyages are allowed between the residence and the school locality to the railwaymen's children, within the limits of the academic circumscription of the parents' residence.

The mother may be entered in the school-travelling card, allotted to a child, less than 10 years of age.

b) *Régie autonome
des Transports parisiens.*

A professional education is organised to make easier the access to working efficiency and the technical and administrative services. The encumbrance is not admitted.

The lectures are administrative and technical. The expenses thereof are partly compensated by the exemption from payment of the apprenticeship tax, the balance being for account of the Administration.

No subscription fee is paid.

The teachers are elected, except in some cases, among the staff.

The wife and children of the railwaymen travel at 1/2 price on the suburb-underground system and the railroad system.

c) *Algerian Railways.*

There is in each district a training school for forming young railwaymen destined later on for acting in the safety and running of trains.

The encumbrance is not admitted there.

The program comprises indispensable matters and visits. The students are trained practically during 8 weeks. Every week they are examined and have to make exercises. The final examination takes place 1 month after the end of lectures.

The expenses are wholly for account of the railway-system.

No subscription fee is paid.

The staff does not participate in the organisation and the working of such education.

The children, till their majority or 28 years of age (on account of their scholarship), benefit by 12 gratuitous voyage permits and cards with 90 % reduction. They have furthermore gratuitous school-tickets for determined periods. Such tickets contain a declassing in relation with the father's permits. The mother may accompany the child if the railwayman applies for and the direction of the Railways gives the authorisation.

d) *Gafsa Railways.*

The professional education is limited to apprentices.

A special subvention is allowed to the parents whose children attend determined schools.

Free-tickets are allowed.

a) *Compagnie fermière
des Chemins de fer tunisiens.*

A professional education is organised for the staff only.

The sons and the grandsons of the staff or the retired-men have the priority to be admitted in the apprentice workshops.

The workers are designated for attending the lectures by the service-chiefs. The courses are given by railwaymen.

The expenses thereof are covered by the railway. No subscription fee is paid.

The staff children benefit by school tickets free of charge. No special facilities are allowed to persons accompanying the children.

Scholarships allowed in special cases.

f) *French Equatorial Africa Railways.*

The question is considered.

g) *French Colonial West Africa Railways.*

The education of the apprentices has been organised by the Railways, which contemplate the creation of evening lectures.

All expenses are covered by the Railways.

Appropriate autocars and trucks transport the children.

h) *Franco-Ethiopian Railways.*

A professional education is organised for the beginning jobs and apprenticeship. Dependent women are admitted to the apprenticeship.

The expenses are included in the working budget. No subscription fee is received. A subvention is allowed to the staff who send their children to France to continue their study.

i) Indo-Chinese Colonial Railways.

A professional education is organised in favour of the staff and encumbrances. It is organised by the Administration by means of specialised monitors.

Directions are given by the management. The expenses are wholly for account of the exploitation budget. No fee is received.

The staff does not participate in the organisation and working of the professional education.

No other organisation fills the lack of official education.

No special commodities are allowed.

7. Greece.*a) State Railways.*

A professional education existed before the war for the security staff, and language lectures were given to the office staff.

The encumbrances do not benefit by this. They had recourse to the railwaymen's club.

A special service, depending on the direction, undertook that work. The teachers were officials-in-chief of the railway, for the account of which the expenses were put.

No fee was received. On the contrary, the pupils benefit by a voyage compensation.

The staff did not participate in the organisation and the working of the professional education.

The staff children resident far from the school, are allowed extra travelling facilities.

b) Piraeus-Athens-Peloponnesus Railway.

Nothing is contemplated in that matter (before the war, 2 schools existed : one technical school and one Railway working school).

8. Hungary.*Hungarian State Railways.*

No answer.

9. Italy.*State Railways.*

A professional education of permanent and irregular character, is organised. Generally, the encumbrances may benefit thereby.

The lectures are given in the Administration rooms, outside of the service hours, by teachers elected among the railwaymen.

The expenses thereof are covered by the contributions of the inscribed staff and by a subvention of the « *leisures* ».

No other commodities exist in the matter of education.

Gratuitous school tickets are allowed to the railwaymen's children, resident in localities without schools.

Brothers and sisters under age and bachelors, being encumbrance of the staff, and living in the same house, benefit by the same advantages.

Free tickets are allowed to accompany boys of less than 14 years of age or girls of less than 18 years of age.

Scholarships allowed to children and orphans of the staff.

10. Luxemburg.*Luxemburg Railways.*

A professional education is organised for the apprentices. The encumbrances do not benefit by that advantage.

The school education is given by a railwayman-teacher; the professional education is given by a worker in the frame of the legal program fixed by the decree of the 5-1-1929.

The budget of 1949 contemplated for apprenticeship and the staff education :

455 000 francs as a remuneration for the apprentices;

515 000 francs for the lectures organisation, teachers' remuneration, etc.;

35 000 francs for equipment and protective clothes.

No special receipt was contemplated.

No subscription fee is received.

The railwaymen's children benefit by free tickets.

11. Norway.

State Railways.

The question is examined.

12. Netherlands and Colonies.

a) *Netherlands Railways.*

A professional education is organised for all functions connected therewith. The encumbrances do not profit thereby.

The lectures are organised according to their nature and importance.

Theoretical lectures are followed by intermediate practical applications.

A Railway school functions in Utrecht and it is destined for railwaymen, who will form the staff directing commercial service and traction service. Duration of lectures : 2 years.

In summer, young railwaymen attending such lectures are sent to Railway stations to be trained.

There are 25 to 30 students per year. Such students receive salaries and are considered therefore as being staff on activity.

All the expenses are borne by the Administration which expects to compensate such expenses by a good output, which it will obtain from the young men who attended such lectures.

The total budget for such lectures is 478 000 florins including remunerations and fees of the teachers and other staff.

No subscription fee is received.

A commission of the parity form controls everything concerning each lecture.

The teachers are selected among the officials, selected and tested as far as the pedagogic training is concerned.

A special fund enables the allowance of

subventions to children specially endowed, in order that they can go through superior courses of study.

School tickets for travelling at reduced prices, are allowed to the pupils.

b) *West Indies State Railways.*

Professional lectures are given by the Railway staff.

13. Portugal and Colonies.

a) *Portuguese Railway Company.*

There is a professional education reserved exclusively to the staff. It is organised by the company, which bears all expenses thereof. An obligatory subscription fee is paid.

The staff does not participate in the organisation.

Travelling commodities and other advantages are not allowed.

b) *State Railways (Mozambique).*

Some professional education was organised to some extent in the form of cultural and professional conferences given by superior officials. No subscription fee is paid.

Free tickets are supplied to railwaymen's children, attending gratuitous schools.

14. Sweden.

State Railways.

There is some professional education reserved to the railwaymen. It is obligatory for obtaining some promotions.

The expenses thereof are for account of the exploitation budget. No subscription fee is paid.

The staff is represented by a council. The children benefit by a gratuitous school permit.

15. Switzerland.

a) *Federal Railways.*

There are, for some classes of the staff, periodic lectures serving to professional

improvement, but such lectures do not aim at improving the administrative situation of the staff.

Officials are sometimes sent to attend special lectures outside of the C. F. F. G. (e.a. lectures teaching the way to conduct and treat men).

The encumbrances do not benefit thereby.

The expenses of the education lectures are for account of the C. F. F. No subscription fee is paid. The organisation belongs to the Administration. There are no further facilities for the encumbrances and the staff or the children have no extra travelling commodities.

b) *Bernese-Alp Railways*
(*Bern-Loetschberg-Simplon.*)

No answer.

c) *Emmental-Burgdorf-Thun Railway.*

Some education is organised by the staff itself, outside of the Administration.

16. Syria.

Damas-Hama and extensions Railways.

Nothing was organised.

17. Turkey.

Turkish State Railways and Harbours.

A professional education was organised for many service lines. The young family members are admitted to apprentice courses for some trades.

The courses serve to form and improve many classes of the staff.

Some specialised workmen are formed.

Polytechnic lectures are paid by the Administration to the young men who conclude an engagement with the company for a period of twice the study duration.

About 50 students attend lectures in such conditions in the U.S.A. and in Switzerland.

All the expenses thereof are for account of the Administration.

No subscription fee for the lectures is imposed.

The staff do not participate in the organisation of such lectures.

The children of railwaymen working in localities having no schools are sent to one of the five boarding-schools, belonging to the Administration.

The schooling costs the father an amount equal to 1/10 of his salary.

Gratuitous voyages for the holidays, feasts, etc. are allotted to the children.

If this is justified by the age of the children, a family member may accompany the children gratuitously.

GROUP 9.

Catering.

1. *Are canteens provided at important stations and offices?*
2. *What is the minimum number of staff required to establish them?*
3. *How are these organised and administered?*
4. *Do the Railway provide the building, heating, and lighting, as also equipment free of cost?*
5. *Are the canteens run by the Railway, or on contract or on a cooperative basis, or under any other form?*
6. *To what extent does staff participate in running these canteens? What is the amount of their contribution in payment of meals or drinks supplied?*
7. *What is the control exercised by the Railway in ensuring that the canteens are run on a satisfactory basis?*
8. *Are employees stores provided either on a cooperative or other basis?*
9. *Does your Railway provide accommodation for the staff who cannot come back home, owing to his duties? Is such accommodation free or is any charge levied?*

ANSWERS.

1. Austria.*Federal Austrian Railways.*

There are no canteens or sales' counters, but kitchens supplying meals at reduced prices. The Administration bears the expenses of hiring, lighting, heating and maintenance and eventually, supplies any lack of the staff contributions.

The moving staff is housed gratuitously, when absenting for service purposes.

2. Belgium and Colony.*a) Belgian National Railways.*

There exist canteens. Their creation is justified when they are wanted by 30 to 40 railwaymen. They are accessible to all the railwaymen on active service.

The prices varying to the extent the basis salary exceeds or not 26 000 francs.

The canteens are administered by a manageress elected by the immediate chief.

She is helped by one cook, when more than 250 000 meals are served. The supply is ascribed to the manageress, to whom is left full initiative, as far as the composition of meals, etc. is concerned, within the limits of prices fixed by the direction.

The working staff for the canteens, depends on the daily production and the local means of action.

The Railway supplies the rooms, the heavy material and pieces of furniture.

The canteens are still managed by the Railway, but an autonomous and controlled working is contemplated.

The staff intervenes by the mediation of entitled organisations which are represented in the various committees or commissions of a parity form, which are concerned with the matter.

The staff participates financially likewise, in the working, as the deficit is covered by the fund of social works, partly fed by the deductions from the remunerations.

The clients pay about 50 % of the real price of the meals.

The direction controls the activity, the staff, checks the prices and the use of the foodstuffs.

Intermediate chief is liable for the good administration.

The financial direction controls the activity financially.

The inspectors of the staff, the social service and financial inspectors, exert permanent or yearly controls.

There are no selling-counters.

The moving staff absent for service purposes has free and gratuitous access to the bed-rooms.

The bed-rooms which are available can be occupied provided that a lump price is paid, by railwaymen obliged to be absent more than 12 hours.

*b) Société Nationale
des Chemins de fer Vicinaux.*

There are some free bed-rooms at the disposal of such workmen, who could not get home on the same day, which happens seldom.

c) Otraco.

There are canteens in favour of coloured staff.

The Administration thereof is effected by the European staff.

The Otraco undertakes the supply of foodstuffs and the sales are made at cost prices.

The rooms, heating, lighting and equipment are supplied gratis.

The staff does not intervene in the exploitation thereof.

The Administration controls the coupons and makes regular inventories.

There are no more selling counters.

The staff which cannot get home the same day, for reasons of service, is housed free.

3. Denmark.

State Railways.

There are canteens in the important working places. Some are contracted for and others constitute cooperative societies in which the Administration and trade-unions are represented.

Rooms, heating, lighting and equipment are supplied gratuitously.

Meals and beverages are supplied at normal prices.

The control is exerted by a supervising committee, with representation of the Administration and staff.

There are no selling counters.

When the staff is obliged to absent, it is housed free.

4. Spain.

Red Nacional de los Ferrocarriles Españoles.

No answer.

5. Finland.

State Railways.

There are canteens in the sites of the Railways, organised by the Administration, which supplies gratuitously rooms, heating, lighting and equipment.

Such canteens can be exploited by the State enterprises or by means of contracts or a cooperative society.

The staff pays a moderate price. The control is exerted by the site chief or his delegate.

Canteens in the form of cooperatives have been established by the workmen in some central workshops. There exist 1 or 2 limited companies founded by the railwaymen.

The workmen obliged to absent for service purposes are housed free of charge.

6. France. — Algeria and Tunisia, Colonies and Protectorates.

a) French National Railways.

In 1949, there existed 360 canteens for the whole Railway-system.

They are created according to needs. There are no fixed rules as far as the number of workmen is concerned, but it is estimated that at least about fifty rations are served every day.

Each canteen is administered by a local committee, in which are represented the S.N.C.F. and the staff. Such committee depends on either a mixed established committee or a local committee of social activity. The staff and the S.N.C.F. appoint their respective representatives. The direction committee appoints its president among the delegates of the S.N.C.F. and elects also the manager, who is exceptionally a railwayman.

The staff of the canteen is selected by the manager outside of the S.N.C.F. and put under the supervision of the direction committee.

The S.N.C.F. installs gratuitously the canteens in its own premises and undertakes all the expenses of creation and installation, the purchase and maintenance of the heavy material, the purchase of the small material, the expenses of maintenance, heating, lighting and water consumption.

The canteen has to cover all further expenses and to pay the prices of meals accordingly.

The canteens are considered as social activities and are administered by their direction committee in which the staff is represented.

The consumer pays in principal the actual cost of the foodstuffs.

The S.N.C.F. intervenes for the balance, without exceeding however 1/3 of the whole cost price, including bread and drinks.

An absolute and uniform price level is fixed. If it is exceeded the balance is for account of the canteen.

The S.N.C.F. exerts its control of the administration and finance of canteens by its representatives, in the direction committee or by means of its services, i.e. its responsible technical or administrative services.

The working of selling-counters in favour of railwaymen on active service or retired men is effected by one steward. Such stewardship results from the amalgamation in 1949 of 4 regional stewardships created by the Railway companies. The S.N.C.F. alone could keep up stewardships as the law of the 25-3-1910 had suppressed all the other patronal stewardships. The stewardship is allowed the financial autonomy in the frame of the S.N.C.F. and possesses his special budget.

It must not make any profit. The treasury is controlled by the S.N.C.F.

The stewardship uses permanent railwaymen and auxiliaries directly selected.

It has 15 wholesale stores, 208 retail stores, 6 store-trains, 46 store-cars, 18 sites of fuels for about 2 millions of consumers. turnovers in 1949 : more than 10 billions francs.

The stewardship is administered by a board of directors, whose president is elected by the board of directors of the S.N.C.F.

It possesses powers necessary for its administration; it appoints the director and the secretary general; it has constituted in its organism a permanent committee. They meet periodically and alternatively.

In all the regions of South-East France and of the Mediterranean, which did not possess stewardships, function various cooperative societies, grouped in the *Fédécoopérail*. They supply rations to 300 000 consumers. Turnovers in 1948: 2 364 000 000.

That formula enables eventual returns of prices at the end of the financial year. *Fédécoopérail* has created likewise social works for the benefit of its co-operators.

The stewardship and the *Fédécoopérail* rendered very important services during the

war and after the liberation as official distributing and inspecting agents for food-stuffs and clothes supplies to be ascribed to the staff of the S.N.C.F., on the national or professional plan.

Dormitories and individual bed-rooms are put free of charge at the disposal of the moving, inspecting or controlling staff, obliged to sleep away from home, for service reasons.

In that case, the subventions for absence from home, are reduced, when such railwaymen use those installations.

b) *Régie autonome des Transports parisiens.*

There exists one canteen which feeds the refectories in the central services, the sheds and workshops of the railway-systems; about 5 000 meals are served daily in the 58 refectories.

The central committee of enterprise administers that canteen. A central kitchen and 4 annexed kitchens serve for the preparation of the meals, which are transported to the refectories.

The rooms are supplied by the company. The equipment and general expenses are for account of the committee. Such committee, composed of members elected by the staff, has created a (canteen and cooperative) — commission. The actual price of the meals is 75 francs, the drink not included. The committee renders account every year about its administration. Eventual claims are sent to the Administration by the way of the trade-unions.

There are two co-operatives of consumers. No railwayman is to sleep away from home for service purposes.

c) *Algerian Railways.*

Canteens are created by the Railways in specially less favoured centres.

They are administered by the Railway system under the direction of one manager appointed by the local officials.

The Railways supply, free of charge, the rooms, heating, lighting and equipment of the canteens which are under its management.

The meals are to be paid and the price is in relation with the food compensation paid to the moving railwaymen.

The management is controlled by one inspector of the supply service.

In some centres, there are selling-stores managed as co-operative societies.

Bed-rooms are installed in the building of the Railways and receive gratuitously the staff of the trains and of the locomotives.

d) *Gafsa Railways.*

There is nothing in that domain, but the railwaymen, working near the mines of the company, benefit by the selling-stores of the mines (administered by the direction of the mines).

A branch destined for the railwaymen will be installed shortly in Gafsa.

e) *Compagnie fermière
des Chemins de fer tunisiens.*

The company possesses one canteen in the registered office, which is destined for the Paris services.

The working thereof requires a minimum of 60 clients.

The organisation and administration are effected by the direction with the prize. The canteen itself is exploited by the company.

The Railways supply gratuitously the rooms, lighting and equipment.

The staff pays an inclusive price for the meals and further expenses are for account of the company.

The committee of enterprise keeps the direction informed about the working and the financial situation of the canteen.

Syndical delegates can address their claims or their suggestions to such committee.

Selling counters have been installed in

the big centres; they have been managed by the Railway.

Bed-rooms and refectories are installed in some stations of the Railway system, and are destined in principle for the service of the trains. The use of the bed-rooms involves a reduction of the travelling compensation.

f) *French Equatorial Africa Railways.*

The Railways possess one selling-store, which receives advances supplied from the Railway budget. The principal installation is in Punta Negra. A branch exists in Brazzaville and one grocery-waggon travels on the Railway line.

g) *French West Africa Colonial Railways.*

The Railways have one co-operative garden and 5 co-operative societies.

The company does not intervene in the organisation or in the administration.

It supplies very great material facilities and a financial subvention (25 000 francs in 1949).

h) *Franco-Ethiopian Railway.*

The company supplies a free meal on the working days to some railwaymen of the French Somaly-Coast.

There is one stewardship which will be transformed to a co-operative society.

The company supplies furthermore to the staff working along the line, foodstuffs and some principal articles partly gratuitously and partly onerously and in a facultative way. The European staff benefits by gratuitous housing.

i) *Indo-Chinese Colonial Railways.*

There are selling-counters in important centres and special markets in the workers' quarters. They are managed by a council service and the administration is controlled by a council composed of 2 delegates of the direction and 2 delegates of the staff.

The stewardship-rooms are supplied by the Railways.

The selling stores are exploited by staff of the Administration, controlled by the social service.

7. Greece.

a) *State Railways.*

There are independent and autonomous co-operative societies administered by an administrative council.

Dormitories or dormitory-cars are put gratuitously at the disposal of the train staff.

b) *Piraeus-Athene-Peloponnesus Railways.*

There is a kitchen for the workers of the central Piraeus-workshops. A statement of participation must be made at the beginning of each week.

The participating staff pays a fixed sum each week, such sum covering about 60 % of the costs.

There are co-operative stores selling at a price somewhat lower than in the current stores.

The Railway does not participate in their organisation, but allows gratuitous transport for travelling there and pays the salary of the co-operative store-staff.

8. Hungary.

Hungarian State Railways.

No answer.

9. Italy.

State Railways.

There are canteens and bars in most of the « *leisures* » sections.

100 members are sufficient for forming a « *leisure* » group. The canteens are managed either as enterprises or directly by the « *leisures* ».

In the first case, the contractor organises and administers the canteen willingly, but the price of the meals may not exceed 75 % of the price of the 3rd class institutions. In the second case, the products are bought by the « *leisures* » of the place and sold at reduced prices.

The Railways supply gratuitously rooms, heating, lighting and equipment of the canteens and fuel for the kitchens.

The canteens are controlled by one inspector appointed by the board of directors of the « *leisures* ».

The central office of the « *leisures* » controls the canteens too, by one official specially appointed and belonging to the office of the group-chief.

There are no selling-counters.

The staff absent for service purposes is housed gratuitously.

Other classes of staff can be housed too at a reduced rate.

10. Luxembourg.

Luxembourg Railways.

The professional organisations created selling-counters for their members, under their own administration and liability.

11. Norway.

State Railways.

There are still in limited number Railway canteens. At least 100 participating railwaymen are required.

The canteens are administered and exploited by the staff in the form of co-operative societies.

The Railways supply rooms, heating, lighting and equipment, free but do not control such canteens.

There are no selling-counters.

The staff, who must travel is not boarded in the rooms of the Railways.

12. Netherlands and Colonies.

a) *Netherlands Railways.*

The « foundation of canteens » created by the association of the anti-alcoholic railwaymen, is operating 5 canteens for the staff, without aiming at making profits. There is no fixed minimum of participating railwaymen for establishing such canteens.

The Railways supply rooms and pieces of furniture free.

One representative of the staff council forms a part of the direction of the « Foundation ». The Administration is represented too. There are no selling counters.

The staff sleeping away from home is not boarded free.

b) *East Indies State Railways.*

No answer.

13. Portugal and Colonies.

a) *Portuguese Railway Company.*

There are canteens. No limitation is fixed as far as their constitution is concerned. They are organised and administered by the delegates of the direction and exploited by the Railways.

The Railways supply rooms, heating, lighting and equipment free.

The railwaymen pay 1/3 of the meal price.

The canteens are controlled by the delegates of the Railways.

There are food stores exploited directly by the Railways.

The regional staff, obliged to sleep away from home, is boarded free.

b) *State Railways (Mozambique).*

There are canteens. The company supplies gratuitously rooms, heating, lighting, and equipment.

Such canteens are exploited directly by the « clubs ».

The prices fixed to the staff are as low as possible. The canteens are controlled by the Railway, by the mediation of the president of the direction and the Railway chiefs. There are no selling counters.

The staff obliged to sleep away from home, is boarded free.

14. Sweden.

State Railways.

There are canteens in the most important workshops. 300 railwaymen are required for establishing one canteen. They are managed as co-operative societies.

The Railways supply gratuitously rooms, heating, lighting and equipment.

The meals are supplied at cost price.

The control is settled by a contract concluded between the chief of each workshop and the workers. There are no selling counters.

The train staff, obliged to sleep away from home, is boarded free.

15. Switzerland.

a) *Federal Railways.*

There are actually 26 canteens created according to the needs. No alcohol is supplied there. Refectories are organised like restaurants. Their management is entrusted to associations of public utility, for account of the F.R.

The Railways supply rooms, heating, lighting and equipment free. The staff does not participate in the exploitation thereof. The prices correspond approximately to the cost price.

The control is practically in daily visits of the staff itself.

The exploitation accounts are controlled quarterly by the direction of the staff. The canteens are controlled by the medical services as far as hygiene is concerned. There are seldom any claims about the canteens. There are no selling counters.

The travelling staff, obliged to sleep away from home is supplied with free beds. Other railwaymen have to hire a bed-room. They receive a compensation therefor.

b) *Bernese Alp Railways.*
(*Bern-Loetschberg-Simplon.*)

No answer.

c) *Emmental-Burgdorf-Thun Railway.*

There are no canteens.

16. Syria.

Damas-Hama and extensions Railways.

There are no canteens and no selling counters.

17. Turkey.

Turkish State Railways and Harbours.

There are no canteens. A free meal is supplied at 12 o'clock, to all the workmen of the workshops.

There is one selling counter in the registered office of the Railways and in the center of each administrative direction.

Such counters are managed like co-operative societies; the capital thereof belongs exclusively to the staff.

The Administration allows, in principle, lodging to all the railwaymen having their service residence in distant spot.

The railwaymen, whose presence may be required at any moment, are entitled to gratuitous lodging too. Such railwaymen are lodged, in principle, in buildings belonging to the Railways.

If such buildings are not sufficient, the railwaymen hire a lodging near the Railway and receive a compensation.

On the contrary, if there are too many lodging houses belonging to the Railways, the surplus is hired, at moderate price, to the railwaymen not entitled to gratuitous lodging.

The Railways allow furthermore compensation for heating in the cold regions and a stay compensation in the unhealthy countries.

GROUP 10.

Welfare.

1. *What is the range and scope of welfare work organised by the Railway.*
2. *Is a separate yearly allotment kept apart for welfare work and if so, is it based on a percentage of the gross or net revenue or on the number of staff employed? What is the percentage of expenditure to total revenue for the last five years?*
3. *To what extent staff are permitted to participate in the welfare organization and what is the control exercised by the Administration?*
4. *Do the welfare organizations formulate schemes for the planning of housing accommodation, improvements to existing staff quarters, general sanitary conditions in Railway colonies, office accommodation and similar matters of general welfare. If there are building societies, are such organizations included in the welfare?*
5. *Is monetary or material aid given to staff who are needy and if so what are the terms and conditions?*
6. *Do you provide loans at very low rate of interest or without interest for special purposes? Give details.*
7. *Does the welfare organization arrange adequate facilities for annual holidays?*
8. *Have you got children's homes, for the children of your staff? What are the conditions of admission? Give particulars about the management and financing of these homes? Have the staff part in controlling the management of same?*
9. *Has your Administration created a service for labour security and hygiene? How is it administered?*
10. *Does the legal system of social security existing in your country include retir-*

ing pensions, old-age pensions, pensions for premature disablement and widow's pensions, etc.? Does the legal pension system apply to your Administration? If such is the case, is it included in the whole of your social services or does it constitute an independent service or have you eventually a system of your own?

11. *Is there any special legislation in your country regarding assistance to unemployed?*

If such legislation applicable to your Railway or is the benefit of such legislation given directly to the surplus staff discharged from service?

ANSWER.

1. Austria.

Austrian Federal Railways.

There is no social welfare in the indicated sense of the word.

Financial subsidies, not at call, are granted in certain cases.

No loans of honour or special facilities are granted for annual holidays.

No homes for children have been created for railwaymen's children.

The Railways have their own allowance regulations. The other applications of social welfare are included in the legal system.

The legal unemployment insurance protects the workers but not the civil servants.

2. Belgium and Colony.

a) *Belgian National Railways.*

The purpose of the social welfare is to sponsor the wellbeing of the beneficiaries (viz. all retired or working agents and their families) in securing for them the material or moral help they might need.

There is no distinctive allowance for social welfare.

The percentage expenditure for social aid compared with the receipts in the fund of the social institutions was 0.48 % from 1-7-45 to 31-12-47, 0.27 % in 1948 and 0.38 % in 1949.

The staff takes part in the organisation of the social welfare through its delegates in the different committees. The control of the society is automatic, as its financial service keeps the books of the different activities involved.

The social institutions deal with reconstruction for all victims either working agents or retired personnel. They deal with the general sanitary conditions in Railway homes.

The social services see to the application of all legal arrangements concerning the equipments to be put at disposal of the staff (public health, etc.).

There are two societies for loans on mortgage but they are not included in the social institutions.

A financial support is granted, according to the situation, to affiliates who can not meet their liabilities as a result of circumstances independent of their will.

Loans of honour are granted to working agents, either in case of misfortune (at a 2 % rate from which they may be dispensed) or to complete the building up of their homes (maximum 15 000 francs at 3.75 % rate) or at the moment of their marriage (maximum 10 000 francs) or to support the studies of a gifted child.

There are two organised homes for children where priority is given to children who for social reasons must be taken away from their families; then to the weak children (medical administration); and finally to children whose sojourn in these homes is deemed useful (medical administration).

These homes are managed by the national committee of social institutions. The expenditures are covered by :

— subsidies from the national institution of infancy;

— contributions from the parents to the lodging expenses;

— funds from the social organisation.

The staff participates in the management by the fact that all committees are constituted on a parity form.

A security and health service of labour is being established.

The legal system of social security embodies the pensions but is not applicable to the S.N.C.B., which has its own system more advantageous than the legal one.

There is a legal system for unemployment insurance, which is not applied to the permanent employees.

b) *Société Nationale des Chemins de fer Vicinaux.*

Eight social assistants help the agents' families to solve their moral and material problems.

The expenses necessary to the social staff and equipment are charged to the Administration. The money for this assistance comes from the fund of family allowances and from the society.

The personnel does not take part in the administration of the social welfare.

The social service has no part in building houses or in loans on mortgage.

The improvement of the working places is dealt with by the health and security committees recently formed.

Supports of which the amount never exceeds 5 000 francs yearly are granted. Loans of honour are not granted.

It has been proposed to sponsor social tourism.

The children are put in holiday camps or organised homes belonging to specialised institutions and at the expense of the social welfare with a small contribution from the parents. Besides, the personnel has formed a non profit organisation which has a holiday camp at the sea-side.

There is also a security and health service of labour.

The social service only steps in to make sure that the law is respected in both autonomous pensions funds of the society.

There is in the country a legal system of unemployment insurance.

As regards the agents, who are not tied down by these insurances, they may be assured on retirement of a part of their salary during nine years and at the most until they are 65 years old.

c) *Otraco.*

Six social centres work solely for the coloured personnel. All expenditure is supported by Otraco.

The control of the social institutions is effected through the responsible department.

Otraco builds houses for the coloured personnel and for the Europeans and makes sure that the general sanitary conditions are respected.

A financial help is granted (loans or advances) for the building trade, the buying of bicycles and of sewing machines or as a marriage settlement. These advances are interest-free.

There is a legal allowance system for all Europeans but not for the natives. Otraco has formed a free system for disability and old age allowance as regards these two classes.

The government of the colony insures a financial help to involuntary unemployed workmen.

4. Denmark.

State Railways.

Subsides of 300 crowns maximum may be granted to certain classes of agents in a hard up position.

Loans of honour as high as half of the annual salary are consented; reimbursement within 6 years at a rate of 4 %.

There are no homes for children.

Permanent agents of the Railways are entitled to an old age or disability allowance. Widows and children also obtain a pension.

There is a legal system of unemployment insurance but the Administration does not take part in it.

5. Spain.

Red Nacional de los Ferrocarriles Españoles.

The social service deals mainly with the serious social diseases : tuberculosis and venereal diseases, infantile and maternal mortality, etc...

Supports both monetary or in kind are granted to needy personnel. A financial help going from 25 to 100 % of the salary is given to agents in sanatoria, who have reached the age limit.

A board composed of engineers and other specialists and of a chief medical officer of the area deals with the health and security problems of labour.

5. Finland.

State Railways.

The Railways budget provides a special allowance for social institutions.

The social services deal with housing and sanitary problems but there is no society for loans on mortgage for railwaymen.

A help either financial or in kind may be granted but no loans of honour are consented.

Facilities for holidays (reservations in holiday resorts and financial support for the sejour) are granted.

The creation of homes for children is being studied.

The health and security service of labour forms a part of the general social service.

The legal system for the retirement of the common people, established in 1937 is applicable to all. There is no legal system of unemployment insurance.

6. France, Algeria and Tunisia, Colonies and Pretectorates.

a) French National Railways.

The activities of the social welfare include every thing dealing with the life of the agent, his family and his home altogether.

- These activities have a triple purpose :
- helping the agent and his own within the family limits;
 - helping to prevent any trial and to keep an eye on the difficulties of every day life;
 - teaching every one the methods of using these means.

Every social assistant has a given area. She remains at disposal of the agents and of the members of their families, receives them or visits them, advises them and sponsors them. They do not take part in professional questions. They should never force themselves on people; they are tied by professional secrecy and act freely towards everyone.

They have a social centre and stations; sometimes they hold a small social health centre where they can get assistance. They also deal with kindergarden and household centres.

The social welfare includes a section of vocational guidance. It assures the management of a certain number of reception and rest centres for children, youth and grown up people.

The social welfare is allotted the credits necessary to its efficient working. These figures are shown in the general budget of the social services and are established according to the needs.

The organisation and the work of the social welfare are closely surveyed by the central and local committee of the social activities where representatives of the personnel are seated.

The social activities deal with the distribution, the improvement and the assignment of the premises provided and reserved for the accommodation of the agents.

The S.N.C.F. builds dwellings which may be divided into 3 different classes :

— Those which correspond to functions whose holder has free accommodation and must live there in order to be able to comply with all requisitions.

— Those which are occupied by paying agents who must have their accommodation next to their working place.

— Those which are generally occupied against payment of a rent and are allocated by mutual agreement.

In 1939, the S.N.C.F. had at its disposal 65 000 dwellings (at the present time, 48 000). It endeavours to rebuild its cities and houses which have been destroyed. Supplementary plans are being elaborated and studied but the necessary funds are lacking. On the other hand the S.N.C.F. provides facilities for the building, improvement and enlarging of houses owned by its agents through the granting of loans reimbursed by monthly deductions from their salary.

A help either financial or in kind (aid, advances, ex-dividend or loans with a small interest) can be given to stricken personnel.

Loans of honour are generally granted for higher studies to children of agents (reimbursement within 10 years, no interest).

The S.N.C.F. has created and fitted up a certain number of reception, rest and recovery centres for children of agents. These centres come under the management of the social services and the payment of the expenditures necessary to their good working is effected through them. The families pay a share of the board and lodging expenses.

The control is assured by several committees already mentioned and where the representatives of the personnel are seated.

The central service of the personnel includes a department of social security dealing with labour security. Moreover, at the level of the general Administration there is a high commission of labour security.

An inspector of each of the 3 main services follows up all the problems dealing with the prevention of injuries to workmen. They are assisted by local technical delegates and at the local level, there are security local delegates.

There is a legal system of old age pensions but the Railways have a special system of their own. No legal unemployment insurance exists but there is a relief system.

b) Régie autonome des Transports parisiens.

Four social assistants find places only for the important patients, advise the agents and their families, enquire about the families of agent brought to the attention of the medical services.

There is no distinctive allocation given to social welfare. The control is ensured by the personnel (provident fund) and by the Administration (medical service).

Professional committees are in charge of health questions and labour improvements and there is also a premises commission.

No societies for loans on mortgage exist but the Administration has been authorised to grant them on request. After enquiry, support (10 000 francs max.) may be given but no loans of honour.

One finds rest centres for the holiday of the agents and their families. Six holiday camps provide a yearly accommodation for about 2 000 children between 6 and 14 years old. The cost is 150 francs per day; these camps are managed by the institution « Children of the Underground » with participation of the committee of enterprise. There is also another reception centre for children whose mother and father disappeared in the course of the war and holiday camping grounds for youth from 14 to 18 years old.

Problems connected with health and labour security are put into the hands of a committee formed in pursuance of the law in force since the 24-5-46 and the chairman of which is the general manager

of the State control, and the personnel is also widely represented.

The legal system of old age pensions is not applicable to the staff of the State control which benefits by a special system through the retiring service.

The agents dismissed by the R. A. T. P. may join the legal system of unemployment insurance.

c) *Algerian Railways.*

The social welfare includes lodging, cooperatives and canteens, aid to infancy, technical education, labour conditions; credit and support; entertainment, retirement and mutualities.

There is no distinctive budget and the staff has no share in the organisation of the social welfare. In certain areas, the Railway undertakes the building of houses; it also endeavours to improve the premises placed at disposal of the personnel, but there is no society for loans on mortgage.

Help in the form of advances ex-dividend or monetary support is granted but no loans of honour.

The Railways does not have any home for children.

The deport chiefs, assisted by a delegation of the personnel, deal with security and labour health questions.

There is a pension fund independent of the Algerian Railways but no legal system of unemployment insurance.

d) *Gafsa Railways.*

The service of social welfare was recently established; its importance is still very small.

Support or advances are granted according to the cases and after guidance of the social service.

A pension fund peculiar to the Railways works under the control of the State.

e) *Compagnie fermière des Chemins de Fer tunisiens.*

Social activities consist mainly of the medical services, the stationery office, the

movies, the holiday camps, the sportive and artistic institutions, etc...

All expenses are charged to the Railways. The staff ensures the management of the mutual, sportive, artistic and touristic institutions and the movies.

There is no society for loans on mortgage; a help either financial or in kind may be granted but no regulations have been made so far.

The company has no homes for children and has not established a service of security and health labour. There is no legal system of retirement, old age or prematured disability allowances but the company has a special system of retirement allowances.

A legal system of unemployment insurance does not exist but the company endeavours to place the members of the staff who are unemployed.

f) *Equatorial Africa French Railways.*

The social welfare activities are : retirement allowances and help to needy personnel.

g) *West Africa Colonial Railways.*

The social service is about to be established. An annual credit will be consented by the board of Administration. The personnel can make suggestions through its representatives.

A financial help may be granted to the personnel on guidance of a commission.

There are no homes for children and the legal system of unemployment insurance is not in force.

h) *Franco-Ethiopian Railways.*

There is no organised social service. Advances may be granted to needy agents but no loans of honour.

A summer camp has been formed for children. Expenditures, with the exception of the personnel's salaries on the premises, are paid by the users.

The security and health service of labour is being reorganised. There is no legal system of retirement and old age allowances and of unemployment insurance but the company has its own system of pensions.

i) *Indo-China Colonial Railways.*

The State control has undertaken the building of dwellings for the staff : advantageous conditions.

A fellowship committee may grant a financial help to needy personnel but no loans are consented. Delegates appointed by the staff and recognised by the State control work with the security of labour in each department.

There is no legal system of social security, retirement pensions, or unemployment insurance but the company has its own system as regards retirements.

7. Greece.

a) *State Railways.*

The social welfare helps to own property and to organise messes. There is a holiday camp in the open air for children of affiliates — 7 to 12 years old — sojourn charged to the fund of mutual aid.

Hygiene labour questions are in the hands of the medical service. There is no special service of security of labour but each department takes severe precautionary measures.

There is a legal system of retirement allowances but the Railways have their own system. The legal system for unemployment insurance is not in force in the Railways.

b) *Piraeus-Athens-Peloponnesus Railways.*

A holiday camp for children of agents works in summer time : the expenses are covered by the Railways and the fund of mutual aid.

8. Hungary.

Hungarian State Railways.

No reply.

9. Italy.

State Railways.

The social welfare includes sanitary assistance, economic and financial assistance, provident insurance society, entertainment, sports and cultural activities.

The expenditures higher than the receipts are shown in different accounts.

The personnel takes part in the organisation of the social welfare through its unions or by elective representation.

The central sanitary department deals with the hygiene of premises, buildings, installations, holiday camps and schools. There is no society for loans on mortgage.

A financial help may be granted to those who have exhausted all other means (budget provided for this end in 1949-50 : 31,5 millions lire). No help in kind. Loans at a low interest rate are consented.

War invalids can obtain supplementary holidays.

Certain organisations « *leisures* » organise recovery and resting sejour in 16 holiday camps managed by the provident institution and receive, free, children from 7 to 12 years old.

The central sanitary office deals with health and security of labour.

A special fund ensures the retirement, prematured disability and survival pensions.

The legal system of unemployment insurance is applicable to the temporary personnel.

10. Luxembourg.

State Railways.

A social aid educates and guides the agents and their families.

The air fund works in case of serious diseases or misery. The annual budget allotted to social welfare amounts to 200 000 francs.

Each case is considered separately and dealt with according to the circumstances and to the position of the person.

The staff does not take part in the organisation of the social welfare.

A service of studies and enquiries endeavours to draw conclusions on accidents of all kind. The Railways, which have their own system of retirement allowances, need not to comply with the legal system.

There is a legal system of unemployment insurance.

11. Norway.

State Railways.

Since 1949 there is a department for studies and application of the social schemes to the Railways. There is also a legal system of unemployment insurance.

12. Netherlands and Colonies.

a) Netherlands Railways.

A foundation for social welfare works independently and its funds are autonomous. It includes social aids (covered by the Railways) and household aids (covered by the foundation). It grants material and moral support to agents, retired agents and their families.

The Administration gives an equal contribution to the one provided by the personnel. The management is in the hands of 5 members at least; they are appointed by the general managing board and the Administration carries out an administrative control.

The foundation does not deal with construction or reconstruction problems. However, it may grant, after enquiry, a help either financial or in kind or some loans of honour.

Facilities for a holiday may also be consented to mothers in case of necessity.

The legal regulations as regards the security of labour is closely watched by State inspectors.

A legal system of retirement allowances is applicable to statutory personnel. Its

application is ensured by the retirement fund which belongs to the general service.

There is a temporary legal system of unemployment insurance applicable to the temporary personnel of the Railways but a special system is applicable to the statutory personnel.

b) Dutch Indies State Railways.

No reply.

13. Portugal and Colonies.

a) Portuguese Railways Company.

The social activities include pensions and discharge funds, and subsidies to families, welfare centre, and holiday camps.

The medical department deals with problems of health and security of labour. The legal system of old age, retirement pensions and unemployment insurance is not applicable to the Railways.

b) State Railways (Mozambique).

No social department has been organised.

The Administration is building houses for the agents. There is a legal system of pensions applicable to the company but no legal system of unemployment insurance.

14. Sweden.

State Railways.

No social activities have been organised by the Railways.

The existing law on security and health of labour is applicable to the Railways together with the legal system of pensions.

15. Switzerland.

a) Federal Railways.

The social activities include : all questions of principle in connection with the reports of the duties performed by the personnel; investigation of all sorts of problems relative to the staff; loans and

relief to needy agents; organisation and distribution of medical cares; prevention of accidents.

The Federal Railways pay yearly contributions to the sickness fund of their personnel, to the pensions fund and to the accidents insurance.

In recent years these allowances from the Federal Railways amounted to 60 millions francs per year.

The staff has a survey right in the different funds but they are managed by the Administration. The Federal Railways grant wide loans on the pension funds in order to sponsor the construction or reconstruction of houses.

In numerous areas, the agents are joined up in cooperative companies for the construction of houses. A financial support may be given and its amount is established by the commission qualified for that purpose.

Loans are granted on advantageous conditions but on a number of such conditions.

A special department connected with the management of the staff deals with the prevention of accidents.

The health questions of labour are in hands of the medical department and of the chief of the department.

The Federal Railways personnel is submitted to the legal old age insurance. Beside, they have their own relief and pension funds and are insured against all accidents. The direction of personnel deals with the management of all these insurances.

The unemployment insurance is not obligatory in the country except for the temporary Federal Railways agents.

b) *Bernese Alps Railways*
(*Berne-Loetschberg-Simplon*).

The sickness insurance fund established by the Railways on the same principle of mutuality is managed by a commission of 10 affiliates (5 effective members and

5 temporary members) elected by secret vote by the affiliates of various departments.

A contribution to the recovery expenses may be granted to needy affiliates.

The Railways have their own pension and relief fund based on the federal act dated 28-6-89. It is managed by the direction in cooperative with the staff. The management is based on the regulations governing the authorised insurance organisms.

The regulations imposed upon the relief and pension fund provide a lump benefit in case of dismissal without responsibility of the affiliate.

c) *Emmental-Burgdorf-Thun Railways*.

A legal system of unemployment insurance is in force.

16. Syria.

Damas-Hama and extensions Railways.

No social activity has been organised by the Railways and no legal system of pensions or unemployment insurance is in force.

17. Turkey.

State Railways and Ports.

There are laws controlling unions, federations and societies for assistance and charity.

There is a widespread system of houses reserved for agents for reasons of duties.

The general sanitary conditions are submitted to strict control in all the departmental premises.

The legal system as regards pensions is applicable to the statutory (State system) and temporary (private system) personnel.

No legal system of unemployment insurance is in force.

GROUP 11.

General remarks.

1. *Are there any other forms of medical and social services in your Administration? If so, give full particulars.*
2. *Is your system as at present functioning satisfactory?*
Are there any criticisms?
Are important or small changes desirable or considered?

REPLIES.

1. Austria.*Federal Railways.*

No reply.

2. Belgium and Colony.*a) Belgian National Railways.*

There are no other medico-social activities in the S.N.C.B. The social institutions at present in force seem to satisfy the essential needs of the personnel and their expansion will possibly improve the work undertaken.

However the Administration, struck by the constant and considerable increase of expenditure caused by unemployment and sickness and wishing to find the way to realise the important points of its social programme, is studying how to reduce the expenditures in suppressing the abuses without decreasing the advantages granted to real patients.

The programme which has been elaborated includes certain changes. The realisation of these modifications has been adjourned or postponed owing to financial or practical difficulties. They are :

the construction of a medico-surgical clinic;

the foundation of convalescent and resting homes;

the organisation of holiday camps;

the construction of houses for the personnel, etc...

b) Société Nationale des Chemins de fer Vicinaux.

No other medico-social activities.

It would be exaggerated to affirm that the present system is entirely satisfactory for the personnel but it would be difficult and even impossible to bring up substantial changes as :

1) the financial means are very poor to grant new facilities to the agents submitted to the legal system;

2) the possibilities to grant facilities to non submitted agents may not go beyond those given to the agents submitted to the legal system.

At the present time, the equivalence between these two has been practically obtained.

c) Otraco.

No other medico-social activities. The present system is not perfect but satisfies the European personnel as well as the natives.

3. Denmark.*State Railways.*

The present system is satisfactory.

4. Spain.*Red Nacional de los Ferrocarriles Españoles.*

There are for the agents in need, consultations for :

- preventive medicine in general;
- antituberculosis health;
- antivenerious health;
- infantile health;
- pre-natal health.

The social service of the Railways takes in its charge the educational expenses in

deaf and dumb schools for certain agents' sons of modest situation. It also provides toys for children, who come to the consultations.

5. Finland.

State Railways.

Destruction of vermin and rats under control of the chief medical officer.

The present system of the medical department gives satisfaction but more doctors are needed. It is still premature to give an opinion on the social services.

6. France, Algeria, Tunisia, Colonies and Protectorates.

a) *French National Railways.*

The medico-social activities of the S.N.C.F. is not and can not be limited. They are in a position to show their capacities under different forms at the initiative either of social services or of the agents.

The S.N.C.F. issues a professional and social weekly review « No » to inform and educate its agents and their families, a trimestrial review « Medical Informations », some useful guides and some booklets of information and studies on the social services. Finally, a directory which is much appreciated by the agents is issued yearly.

Publicity efforts are periodically undertaken and carried out under different forms for general health questions, to prevent diseases and accidents, etc...

As regards the cultural problems, exchanges of children among French and foreign families are taking place.

The medico-social activities are achieved up to a certain point by the work of associations formed and managed by the agents. The S.N.C.F. continues to support them for all realisations which can still be included in general risky matters and needs of the staff which are not well known yet by the existing organisations.

The present system is the result of a progressive adaptation to the admitted needs of agents and of their families with the resources at disposal of the social services.

It has been established and combined in the frame of the general organisation of the S.N.C.F. The reinstatement has been effected to the best of circumstances by adjusting the possibilities and resources to the necessities and needs. Through not being an object or real criticism it has to be improved in the details and sometimes more important changes should be made.

The aspects of the social problem, the questions to be considered are very different and changing, as the need themselves alter in the course of time and events. The solutions which have to be given can not have a purely administrative character. To be satisfactory, they must :

- quickly respond to every demand of any kind. Efficiency is proportional to the rapidity of acting;

- request little formalities, correspondence and transfers.

The social services must be based upon simple ideas and act according to objective principles with well determined purposes.

They must be widely known by the agents and their families and means of permanent information and broad diffusion must be used.

They must dispose of well equipped installations and of decent material means. And finally, it must always be remembered that the social point of view must before anything else remain essentially educational, in order to be able to prevent and avoid difficulties rather than remedy their consequences.

b) *Regie Autonome des Transports parisiens.*

Autonomous societies of a real importance exist within the autonomous State control; they are :

- 1) The mutual fund of cooperation with the social insurances : all the staff is affil-

iated by payment of a monthly contribution deducted from their salary. The agents families benefit by the contributions of the social security.

Some facilities for the retired agents and the members of their families.

This fund has formed for its members, different social institutions. It also manages the « aerium » at Tarn, for deficient children.

2) The mutualist company of the underground personnel : joins together more than 60 000 affiliates. Reimbursement of disease expenses, various reliefs in case of death, etc...

3) Orphan-home of the French Railways : helps the children of deceased agents.

4) Fraternal of French Railways : formation of a retirement fund and of a relief fund in case of maternity, adversity and death.

5) Federation of ex-service men. Horticultural society — Reparations centres for clothing.

6) Numerous local societies : meetings, parties, excursions, etc.

No criticism to make as regards the present system in force.

c) *Algerian Railways.*

No other medico-social activities.

The personnel wants the formation of a provident fund similar to the one existing for the S.N.C.F. Nothing will be done before the social security is applied to Algeria.

d) *Gafsa Railways.*

No other medical-social activities.

The present system, rather adaptable and working in good conditions, is almost satisfactory. The personnel request a provident fund of the same type as the one of the S.N.C.F.

The conditions of life are very hard. The country is devastated.

It is impossible to foresee the development of the social institutions.

e) *Compagnie fermière des Chemins de fer tunisiens.*

The medico-social activities consist of : special measures for curable tuberculosis or cancerous people — bonus on birth (statutory personnel with a salary of 90 000 francs). Benefit for change of residence — reimbursement of objects damaged or lost in accidents. Renting of buildings managed by the company to the personnel.

f) *Equatorial Africa French Railways.*

A labour code and a system of special security particular to the colonies are being studied. Serious improvements may be expected of the material and social points of view.

g) *West Africa Colonial Railways.*

No other medico-social activities.

The present system is altogether satisfactory.

h) *Franco-Ethiopian Railways.*

No other medico-social activities.

The present system is working satisfactorily. The medico-social services are expanded and improved in proportion to the needs and of the possibilities,

i) *Indo-China Colonial Railways.*

The system is working to the satisfaction of both parts and it has been considered to form social commissions but the Indo-Chinese personnel does not seem to realise the facilities it can bring them.

j) *Marocco Railways.*

No reply.

7. Greece.a) *State Railways.*

No other medico-social activities.

The present system seems to be satisfactory.

No serious changes are being considered.

b) *Piraeus-Athens-Peloponnesus Railways.*

Criticisms of the agents : lack of eagerness from the doctors; encumbrances not well determined — specialities not delivered; refusal by the service of the Railways to provide certain medicines.

Criticisms of the Railways : too heavy charges. Abusive coverage of short absences by the doctors.

A complete and general reorganisation is being considered.

8. Hungary.*State Railways.*

No reply.

9. Italy.*State Railways.*

No other medico-social activities. The present system is entirely satisfactory considering the legitimate wish of further progressive improvement, particularly as regards sickness insurance.

The retired agents wish to benefit by sickness insurance, on payment of a contribution as small as possible.

10. Luxembourg.*Luxembourg Railways.*

No other medico-social activities. The present system is temporary and will only be expanded after appointment of a chief medical officer who is expected soon. He will have to organise the service from the medical point of view.

11. Norway.*State Railways.*

The present system is satisfactory.

12. Netherland and Colonies.*Netherlands Railways.*

The Administration has undertaken biennial X's ray examinations. They are obligatory for the agents and optional for their families.

The present system is satisfactory.

13. Portugal and Colonies.a) *Portuguese Railways Company.*

No reply.

b) *State Railways (Mozambique).*

No other medico-social activities.

The system is satisfactory but the pensions are deemed too small.

No structural change is to be foreseen.

14. Sweden.*State Railways.*

No other medico-social activities.

The present system is satisfactory. Several questions are being studied.

15. Switzerland.a) *Federal Railways.*

The present system is satisfactory.

b) *Bernese Alps Railways
(Berne-Loetschberg-Simplon).*

No reply.

c) *Emmental-Burgdorf-Thun Railways.*

No reply.

16. Syria.

Damas-Hama and extensions Railways.

No other medico-social activities.

No criticisms have been made concerning the present system.

17. Turkey.

State Railways and Harbours.

The present system is satisfactory.

Serious changes are not being considered.

III. Summary of the replies given by the Railways Administrations.

1) Almost every country in respect of which we have received particulars has a legal system of social security and of social solidarity with the exception however of the French Colonies and Protectorates (West Africa, Equatorial Africa, Indo-China, French Coast of the Somali), Algeria and Tunisia.

In Sweden, Finland and in Holland there is no general law on the subject but there are special ones which regulate some well determined social activities.

In the Belgian Congo, the system in force is different for the Europeans and for the natives.

In Turkey, the system applied to State agents is different from the system applied to private workers.

As a general rule, this legal system is obligatory. However, the sickness insurance is optional in Switzerland and so are the old age pensions in Holland.

In Denmark too the legal system is only partly obligatory.

In Belgium the permanent agents of the State, of the provinces, of the boroughs and of the civil services together with all independent workers, are not bound by the legal system.

The laws on this subject were created at the end of the 19th century and specially at the beginning of the 20th century. In

a few countries, rather rare, a rough shape of social legislation appeared some decades earlier : Finland in 1852, Switzerland in 1889, Greece in 1861, Austria in 1887.

This social legislation, wherever it has been established, regulates generally the sickness, works accidents, unemployment insurances and the retirement, incapacity, old age and survival pensions together with the family allowances, the paid holidays, the special holidays and relief in case of maternity and during the nursing period, the funeral expenses, the action against the big plagues, the organisation of leisure, entertainments, etc...

In certain countries with foremost organisation and social legislation these social privileges are granted and regulated under almost every form mentioned above. Let us quote as an example : Belgium, Austria, France, Greece, Hungaria, Italy, Luxemburg, Holland, Portugal, Switzerland and Turkey.

In the other countries the realisations and interventions obtained are more limited, more fragmental and the system is still under permanent developments.

This legal system was not wholly born at once of course. It was actually completed and changed in several countries after the second world war. In Austria between 1945 and 1947; in Belgium the social security was legalized and co-ordinated with the Van Acker decree of 1944; in Finland in 1946 and 1948; in France where the system of the social service is at present based on article 5 of the Atlantic Charter and on recommendations of the « B.I.T. ».

In Luxemburg the old age — incapacity allowance has been reorganized by the law of 1925, the unemployment relief by the decrees of 1931 and 1938 and the health and security system by the law of 1925.

In Holland a temporary law on old age pensions was enacted in 1947, and a law on work accidents enacted in 1946 was completed in 1949. In 1948 another law altered the regulations as regards incapacity and medico-social assistance in case of disease.

In Turkey at the beginning of 1950 the retirement rights were standardized for all State agents and a retirement fund for all private workers was established.

In all the countries which have replied to our questions there is a legal system, obligatory, and which provides indemnities for work accidents and professional diseases.

This system was established at very different times and the oldest, it is believed, appeared in 1888 in Austria.

The essential principles which regulate it are as follows : insurance at charge of the employer, a contract excluding the case when the workman is responsible; indemnity for temporary incapacity and eventually for permanent one; right to necessary cares, to prosthesis, to funeral indemnities and to pension for the widow and the orphans.

The changes which appeared since the creation of the system of indemnities for work accidents and professional diseases have mainly consisted of the extension of the benefit of the law to new categories of salaried personnel; of the raising of the maximum fixed for the application of legal arrangements; and of the putting of accidents which occurred on the way to work on the same footing as the work accidents themselves.

In certain countries the amount of the indemnity and of the pension has been raised. In others, new professional diseases have been accepted as such.

2) The legal system of social security and of social solidarity is applicable to the Railway Administrations in the following countries : Syria, Turkey, Finland, Switzerland (only to the Federal Railways for work accidents), Norway, Holland, Denmark, Greece (with the exception of the Piraeus -Athens - Peloponnesus Railway), Spain, Belgian Congo, Portugal and Austria.

In Italy and in Luxemburg the legal system is applicable only to the non statutory personnel.

In Hungary, there is no legal system of social solidarity. Same applies to France and Belgium where the legal system of social security is not applicable to the statutory personnel but only to the temporary staff (« S.N.C.F., R.A.T.P., S.N.C.B.). In Belgium on the contrary the legal system of social security is applicable to the workmen in the S.N.C.V. (light Railways).

It is not applicable in Algeria, Tunisia, Mozambique and it does not even exist in Equatorial and West Africa (French).

In most Railway Administrations, the legal system is imperative.

The legislation has sometimes enabled the Railway Administrations either to keep the autonomy special to the existing system or to establish a special system, as long as the privileges granted are least equal to those provided by law. Such is the case in France, Holland, Italy and Belgium (S.N.C.B.).

All the Administrations from which we received a reply, have formed a medical service. Among them, Switzerland, Sweden, Portugal, Luxemburg, Greece, Indo-China, Algeria, France, Finland, Spain, Belgium and the Belgian Congo have also created a social service. A similar department, still fragmental, was established in 1947 by the Gafsa Railways.

A few rare Administrations have roughly set out the history of their medico-social services and have pointed out the big changes which have appeared since the beginning.

Belgium : a) S.N.C.B. *Before 1929*, the medical treatment of the agents was in the hands of doctors approved by the State. Free services were only given to victims of work accidents and to the fund of workmen affiliates. *From 1929* a system of social insurances was established for all statutory agents either working or retired : the previous advantages have considerably increased and a medical service is organised. *At the present time* the medical service has divided its activities into two main departments : private and social medicine.

Since 1945, the benefit of the social insurances was extended to the families of the retired and working agents.

b) *S.N.C.V. (Light Railways)*. Since 1945 a medico social service is in force.

c) *Otraco*. The medical service was created in 1935 and the social services in 1947.

Finland : The medical service was created in the course of the last century and the social services in 1946.

France :

a) *S.N.C.F.* — The creation of the medical services was a consequence of the exigencies and of the very special nature that is the Railways civil service. In 1938 the S.N.C.F. taking the place of the Railway companies endeavoured to coordinate, to develop and to extend the social services.

b) *R. A. T. P.* — The medical services started with the beginning of the underground railways in Paris. In 1945, all the social works which had been working independently from one another joined together into a special management.

c) *Algerian Railways*. — The medical services have existed since the very beginning. A social service was created in 1943.

d) *Compagnie fermière des Chemins de fer tunisiens*. — Since the formation of the Company (1880-1884) a medical service was affected to its staff and to staff families.

e) *Franco-Ethiopian Railways*. — Medical services established since the very beginning.

f) *Indo-China Colonial Railways*. — Medical and social services are in force since the beginning in 1903.

Greece : *Piraeus - Athens - Peloponnesus Railways*. — Medico-chemical services and a retirement fund were established under pressure by the agents.

Italy : The present central sanitary office is the result of the merger in 1907 of the

offices created by private companies which ensured the management of the Italian Railways up to that date.

Netherlands : A fund of assistance was formed in 1870. In 1886, the families of the agents are accepted as affiliates. From 1914, the retired agents and their families are beneficiaries.

Switzerland : *Federal Railways*. — A medical service was established in 1916 without any help from the personnel. On their request proper social services were organised.

— The legal system of indemnities for work accidents and professional diseases is applicable to the Railway companies of the following countries : Austria, Belgium, Belgian Congo (the coloured personnel has special and very broad regulations), France, (with the exception of the « Régie Autonome des Transports Parisiens »), Algeria, Tunisia, French West Africa, French Coast of Somalis, Indo-China, Greece, Hungaria, Italy, Luxemburg, Norway, Netherlands, Portugal, Mozambique, Sweden, Switzerland and Turkey.

As a general rule, the department of work accidents and professional diseases is included in the medico-social or medical service of the Railways Administrations.

In Austria, Finland, Hungary, Netherlands and in Turkey it is included in a special service whilst in Indo-China it is incorporated with the department of the personnel and in Norway with the service of general management.

3) The organisation of the medical services is similar in almost every Railway Administration, viz :

— Network divided in sections, radius, areas, and districts under the direction of a medical officer.

These medical officers are dependent on a zone, control or local management and their number is appropriated to the importance of the network.

The local centres are under the management of a chief medical officer who is most

of the time himself connected with the management of the staff.

The medical service is generally divided into two sections :

- 1) medical technical;
- 2) medical administrative.

— As for the social services, few Administrations have informed us of their organisation. The activities of these services are divided into several categories.

Every medical and social section is connected with another management centre : either the general management or the staff management.

— The specialized personnel includes :

a) *on the Continent* : specialized doctors, doctors (general medicine, traumatology, chemists, dentists, nurses, assistant chemists, truss manufacturers, desinfectors, social monitors, social aids, psycho-technicians, advisers for vocational guidance, educational monitors, sports instructors.

b) *Algeria, Morocco, Tunisia, Colonies and Protectorates* : Doctors, auxiliary doctors, chemists, nurses and assistants nurses, midwife, assistant midwife, sicknurse and sanitary agents.

— The specialized personnel is recruited by examination : in Portugal, in Italy, and in the S.N.C.B. (Belgium); — by contract : in the Belgian Congo and in Gafsa Railways; — by references : in Algeria, France and Turkey; — according to the needs : in Sweden.

Other Administrations recruit them by choice or among the staff.

In Austria, Belgium (S.N.C.B.), Switzerland (C.F.R.), Syria and Turkey only the personnel is entirely statutory. In other Railway Administrations they are partly statutory and partly auxiliary or temporary.

— This personnel works generally full time when statutory and part time in other cases.

— As a general rule the specialized personnel is entirely paid by the Railway Administrations; in rare case this is done only partly.

4 A.

The Railway personnel when taken ill, has free choice of a doctor in Belgium, in Luxemburg, Norway, Tunisia and in the Dutch Indies. At the S.N.C.B. however, the victims of work accidents on duty must have recourse to the cares provided by the Railways.

The Railways Bern-Loetschberg-Simplon also allow free choice of the doctor except if the insurance fund has reached a special agreement. The personnel must call either the Railways medical service or the doctor of the Railways or approved by the Railways or to Railways medical centres in the Administrations of the following countries : — Austria, Belgian Congo, Spain, Finland, France, Algeria, Ethiopia (Franco-Ethiopian Railways), Maroc, Greece, Hungaria, Italy and Portugal.

The personnel must call the doctor approved by the relief fund : in Denmark and in the Netherlands.

The Gafsa Railways have two centres which provide simple cares. Otherwise, and for other cares they go to the doctor.

French Equatorial Africa has two centres for treatment which does not require the presence of the doctor. The other cares are provided through the institutions of the Colony. Same applies to West Africa which has already a local medical service and a few district doctors.

In Mozambique and in French Somali the personnel calls in the government institutions.

Nothing has been put at disposal of the personnel by the Swiss Federal Railways and in Syria.

Some rather rare networks have one or several hospitals : Otraco (3 for the natives and a special hospitalization unit for the Europeans); — Finland (1 hospital and four consultation units); — Ethiopia-Franco-Ethiopian Railways (1 hospital and 3 consultation units); — Hungary (1 hospital); — Turkey (2 hospitals and 1 of 10 beds in the Sivas workshops and in each district head office).

The S.N.C.F. does not have a general hospital but its provident fund has just taken over an important hospitalization centre (600 to 700 beds) in the suburbs of Paris. This will satisfy all needs as the maximum.

All cares are given in these hospitals with the exception of the Finland Railways where only non serious cases and patients in observance are treated.

The equipment of these hospitals is : normal in the Belgian Congo, modern for all internal diseases with X'ray equipment in Finland; normal with X'ray equipment and laboratory in Ethiopia; normal with X'ray equipment in Hungary and complete in Turkey. Every one of them except in Finland, have a surgical department.

The S.N.C.F. holds several special places for the treatment of tuberculosis (agents, agents' sons, growing up children of agents: boys until they are 14 years old and girls, 18 years old).

The Railway Administration and ports of the Turkish State are studying the creation of special institutions for the treatment of chronic diseases.

Generally, hospitalization and cares to perambulating patients are also granted to members of the families and even to the encumbrances in the Belgian Congo, in Spain, Tunisia, Hungary, Mozambique and Turkey. The French west African Railways, on the contrary, do not grant medical specialities to members of the family. They do not get hospitalization in the R.A.T.P. in Algeria, Indo-China, Portugal and in Sweden. In Turkey all persons at charge are excluded.

Where there are Railway hospitals they are working under direct control of the Railway.

In Finland, Hungary, Turkey and in France these hospitals are under control of the public health department.

In Ethiopia there is a simple control of the medical and health doings whereas in the Belgian Congo it is sufficient to provide particulars to the Government Department

of the Colony as regards the activities undertaken.

— With the exception of Turkey, Finland and of the Belgian Congo, the personnel is authorized to make suggestions through its committee of enterprise for example as regards the good working of hospitals.

— As a general rule, the members of the staff have facilities of transports to go to the usual hospitals for treatment. The Belgian Congo Administration, the Franco-Ethiopian Railways and Turkey only, give facilities also to encumbrances.

The A.O.F. Railways have an ambulance-waggon. The following countries have one or several ambulances : — Belgium (S.N.C.B.), Belgian Congo, France (S.N.C.F.), Mozambique and Turkey. Transportation is usually free except in the S.N.C.B. where the patients have to pay the cost price.

4. B). The personnel does not seem in any way handicapped to get medical cares. Those from small stations or located far from the big cities, call on the doctor, either Railway doctors or not, or go to dispensaries or consultation centres.

— Railway doctors move about the different areas in order to give medico-chemical assistance in certain colonial networks or in areas with a small number of inhabitants. They are as follows :

Indo-China, Greece (State), Turkey and Tunisia : regular visits. On the Franco-Ethiopian Railways : 1 tour monthly : Syria : one tour weekly; Italy : on well determined days in particular poor areas.

The RENFE (Spain) has a mobile medical unit with X-ray equipment and laboratory. The Franco-Ethiopian Railways have mobile dispensaries and in Turkey it is planned to create a sanitary waggon for each district.

— In Italy (except for injured and malarial personnel) and in Portugal Railway doctors collect their fees from the

agent. In other countries whereas the personnel has to call on the Railway doctor, cares are generally free. Same applies to the members of the family.

— It is not possible to give a summary of the advantages granted to sick agents, victims of works-accidents or agents stricken by professional diseases as regards unemployment and sickness insurance, the period of protection prior to the retirement, the re-employment of semi-valid staff, etc... You are referred to the replies given by each network, the regulations in force being almost as numerous as the number of Administrations.

It may be stated, however that the patients receive the entirety or a part of their salary for a more or less prolonged time, the amount being decreased according to the duration of the absence. There is sometimes a short period of waiting. Numerous networks have vacancies and employments reserved for the semi valid staff whereas others employ them according to their possibilities and without any fixed regulations. Certain networks even dismiss the incapacitated personnel and give them a certain indemnity (temporary annuity or capital).

The victims of work accidents and occupational diseases are generally treated and given more privileges than the ordinary patients. Beside, they have a right to free care and medicines, to prosthesis, and to benefits for temporary or permanent incapacity.

In the Administration of the following countries, the work accidents which happen on the way to work are considered as real work accidents :

Austria, Belgium, Belgian Congo, Finland, France, Algeria, Indo-China, Hungary, Luxemburg, Netherlands, Sweden, together with the Piraeus-Athens-Peloponnesus Railways.

The Franco-Ethiopian Railways follow the French regulations.

— The privileges granted as regards the sickness insurance to members of the family

of agents on duty, to retired personnel and to members of their families can be summarized as follows :

Austria, Belgium, Hungary, : for all, same privileges as these consented to agents on duty; Belgian Congo, A.O.F., Greece, Mozambique, Norway : free cares to families of active agents. Spain : to all rightful claimants cares given by the different specialists; France : privileges at least equal to those provided by the legal system of social security; Italy, Luxemburg, Netherlands : privileges consequent to the affiliation to an insurance fund.

— The railwaymen can generally get necessary treatment for all diseases.

— Where the personnel is not obliged to call on the medical services of the network, the expenses subsequent to the specialists' cares are usually reimbursed either partly or wholly.

The medicines (including specialties) are delivered free : in the Belgian Congo, in Spain (during certain delays), in Finland (hospitalized workmen), A.E.F. (in case of hospitalization if the monthly earning do not reach 40 pounds).

In the other Administrations the usual medicines are free or the expenses are reimbursed either totally or partly.

— There is a home for convalescent personnel : in the R.A.T.P. (France), in A.O.F. (same for all State control and civil service agents), in Morocco (convalescent or summer centres) and in the Netherlands (3 associations formed by the staff running convalescent homes).

4. C). In the majority of the countries the Railway medical services are managed unilaterally by the Administrations.

In the S.N.C.V. (Belgium) the sickness insurance service works line an ordinary mutual insurance company. A committee with a parity form ensures the management of that department.

In France :

— S.N.C.F. : there is no real co-administration with participation of organisms

with a parity form but the staff is represented in the different committees which have the management of the social activities.

— R.A.T.P. : the staff ensures the control and the good working of the services through a provident fund managed itself by a committee of 27 members appointed by the personnel, under the conditions fixed by the regulations of the fund.

The retired agents do not take part in the management.

In the State Railways of Greece, the management is partly assured by the affiliates. The fund of mutual aid is managed by a board of administration composed of 7 members, 3 of them being appointed by the staff.

In Norway the representatives of the personnel (retired agents excluded) are appointed by free choice.

In the B.L.S. (Switzerland) the sickness insurance fund is managed by the Administration and by 5 members appointed at secret polling and by the affiliates.

Finally, it must be mentioned that in Hungary and in Italy where in spite of the unilateral management of the medical service itself the personnel and the retired agents are represented on the Hungarian medico-social services (representatives appointed by the organism in charge of the interests of the staff) and at the board of administration of the Italian Provident Institution.

France, Algeria and Hungary are the only countries which stated that the budget of the medical service is being established on the basis of the previous one and in considering the experiences made in the meantime.

The fund granting the privileges receives different contributions :

S.N.C.B. (contributions of the staff and equal contributions of the company which also pays a subsidy of 3 % on the total amount of treatments and salaries);

S.N.C.V. (equal shares for the affiliates and for the company);

Denmark (subsidy); Greece (State : 5 %

given by the agent and 7 % by the Railway); Piraeus-Athens-Peloponnesus : 3 or 2 % by the agent and 5 or 3,3 % by the company); Hungary (equal shares : 6,5 % of the treatments and salaries); Italy (equal shares : 1,5 % of the earnings); Luxemburg (contributions for 1/3 by the Railways and for 2/3 by the agents; Norway (2,5 % to 3 1/4 % of the treatment by the members plus a subsidy given by the Railways, the State and the communities each of them being equal to 1/11 of the bonus); Switzerland (B.L.S. mainly : 7 % by the agent and 8 % by the company of the earning assured). Otraco bears all the charges and so does the Netherlands and Syria where however a small contribution is asked from the personnel. In the other Administrations all charges are included either in the general budget or in the budget of the plant and the treasury department is usually taken care of by the Railways.

— In Belgium, Luxemburg, in the Dutch Indies, in Switzerland (C.F.F.) and in Gafsa Railways the staff has free choice of the doctor, of the chemist and of the hospital or centre where to go. In the other Administrations they have to call on the Railway doctors or doctors who have been approved by the Railways.

The female staff is generally allowed a maternity leave (from 6 weeks to 3 months, with full salary) and a special holiday for the nursing period. Some Administrations also grant other indemnities for the birth, the layette and the nursing period. Very few Railways grant special advantages to wives of agents or of retired personnel.

Almost every Administration pays a funeral indemnity for deceased agents.

The networks of the S. N. C. V. (Belgium) of Algeria, of Italy and Luxemburg are the only ones which have extended this measure to the retired agents.

It may be said that the medical services takes part everywhere in providing prosthesis sets. It is delivered free of charge to victims of work accidents and in different other cases according to the circumstances.

5) The staff takes part in the social activities of every kind in most of the networks and in return they encourage the staff with more or less important subsidies.

— The social services are unilaterally managed by the Administration of the following networks : Otraco, RENFE; Luxemburg Railways; Netherlands and Turkish State Railways. In Italy, the management differs from one sort of activity to another (either unilaterally or with a reduced representation of the personnel). In the other Administrations they are managed either with a participation of the personnel under a parity form or with reduced representation. The representatives are appointed by their organisations or by free choice.

The retired personnel sometimes takes part in the management whereas they are allowed to benefit by the social privileges. The estimates of the social institutions are generally established on the basis of the expenses of the past year and on certain considerations studied for the future year. There are very few Administrations where the personnel on duty or retired pays a contribution to the fund which ensures the granting of the privileges. The expenditures are generally included in the network budget.

Except a few rare exceptions the treasury department is managed by the Railways.

6) In most of the networks there are clubs, societies, artistic, literary and musical associations. They are usually independent, autonomous and created by the staff under control of their members but with the help and the subsidies of the Administrations. A few very rare networks do not take care of the leisure of their staff.

Holiday camps either free or with a small financial contribution from the personnel, are organised by a large number of networks. It is rather rare that the personnel has to subsidise it all by itself.

Generally in each network and for the good working of the leisure and entertain-

ments institutions, the same ideas of management as for the other social activities is in force, viz : unilateral management either by the Administration or by the personnel or by both or by the personnel with control of the Administration or at least main management ensured by the Administration with a small representation of the personnel through representatives allowed to make suggestions.

The affiliation of the staff to these institutions is always optional. They are generally paid out by the contributions of the personnel affiliated: contributions, entrance fee plus the money obtained by the entertainments and other meetings, the subsidies of the Administrations and the grants.

Sometimes but rarely all expenditures are covered by the Railway which keeps a special subsidy for leasues or writes in the budget of the plant the amount necessary for this purpose.

The R.A.T.P. has allotted in 1948 : 9.5 millions for the cultural and artistic organisations and 23 millions for the reception and resting centres. The Italian Railways give a determined subsidy of 800 000 liras plus 10 lire per year and per member.

Only exceptionnally the first installations and the maintenance in good order are taken care of by the networks. More often the networks support with subsidies or in providing the premises, the furniture and facilities for the lighting and heating equipment.

In the S.N.C.B. 2 150 members are enrolled in the artistic, dramatic and musical institutions and 23 000 in the touristic associations.

In the S.N.C.F. there are 52 000 members in the sports associations and 44 000 in the artistic associations and 80 000 in the touristic associations. The cultural and artistic organisms have more than 5 000 members in the R.A.T.P. 105 in the Railways of Indo-China, 120 000 in the Italian Railways, 3 000 in Luxemburg, 75 of whom are active members; 1 250 in the Railways of the Greek State. The Netherlands Railways

have 10 000 affiliates in their entertainment and touristic associations. 4 000 agents of the Federal Railways of Switzerland are members of sports associations and 1 100 are members of musical and singing associations. In the Railways and ports of the Turkish State the majority of the staff is affiliated but only 10 % of them are active members.

— A good number of Railways grant supplementary and restricted facilities of transport to the agents who participate in these entertainments but hardly ever to the dependents. That is the case for the Otraco, in the Gafsa Railways, in Finland, in the S.N.C.F., in the R.A.T.P., Indo-China, in the Greek State Railways, in the company of the Portugal and Mozambique Railways, of the Swiss Federal Railways, in the Damas-Hama Railways and in the Railways of the Turkish State.

Entertainments are arranged by the Finland Railways, in the S.N.C.F. (on the exclusive initiative of the staff), in the R.A.T.P., in Gafsa Railways, Tunisian, Franco-Ethiopian, Greek, Italian, Luxembourg, Dutch Railways, the Company of Portugal, of the Mozambique, Swiss, Damas-Hama and Turkish Railways.

— Expenses are covered by the agents, by the entrance fees and usually by the subsidies of the Administrations.

— Bars and canteens are very rare; drinks are sold at cost price.

— An educational organisation exists in the Otraco (for members and families of agents) and in the Finland, S. N. C. F., R. A. T. P. Greek State, Italian, Luxembourg, Dutch, Portugal and Federal Railways (Switzerland) (without support from the Administration).

— Everywhere these institutions are opened to members of the agents' families and almost always to the retired agents and to their families.

The entrance conditions are fixed in all freedom by each of these institutions.

7) Certain Administrations, however, granting support to the sports activities or

to their practice, do not give facilities to their personnel in this connection. Training or meetings are out of the working hours. Permissions or facilities or transport are granted however for international meetings.

Other Administrations agree to change the workings hours in order to liberate the players for their match.

Finally, some Administrations are very generous for the granting of supplementary holidays. The service necessities however remain the criterion.

Most of the Railways grant facilities for the installations by putting grounds and premises at disposal of the sports associations and in providing lighting and heating installations and also furniture and the permanent material.

It has to be mentioned that in Turkey the Administration must organize sports institutions in pursuance of the law.

— The practice of every sport is sponsored but their number and kind differ from one country to another. It goes in sympathy with the national preferences or customs and with the financial means.

— The equipment is provided either completely free (Otraco, R.A.T.P., Luxembourg Railways) or partly (Finland and Dutch Indies) or is entirely at charge of the agent or of his sports committee.

As a general rule, the members of sports associations also give a small contribution. In Finland the affiliation is free.

The Railways which hold sports associations of a certain importance, organize meetings or matches for the staff. The expenditures are covered by the entrance fees, by the contributions of the members and also usually by subsidies from the Administration or from the social services fund.

— In a good number of Administrations the staff participates in international competitions or inter-railway meetings. An international organisation formed 4 years ago (U.S.I.C.) has already obtained the affiliation of about 10 Railways. It took

the initiative to organize international championships and endeavours to have them more and more complete.

— The sports associations are generally managed by the staff itself. There is sometimes a central sports committee composed of delegates of the staff and of delegates of the Administration. It is the case for the Austrian Railways, in the R.A.T.P. and in the Mozambique Railways. Where the personnel organises and manages its organisations, there may be a certain control by the Administration.

— The financing of the sports institutions is usually assured from three different sources : contributions and entrance fees of the members; receipts obtained on the occasion of sports meetings and subsidies from the Administrations. The expenditures are entirely covered by the Administrations in Otraco and in the Finland Railways.

No particulars could be obtained as regards the extent of the annual budget. In the R.A.T.P. the committee of enterprise paid 61 millions French francs in 1948; the French Equatorial Africa Railways paid 20 000 francs in 1949; the A.O.F. Railways 370 000 French francs; the Indo-China Railways 20 000 piastres; the Switzerland Federal Railways grant a yearly subsidy of 5 000 Swiss francs.

The sports budget in the Railways and ports of the Turkish State reaches 80 000 Turkish pounds yearly.

8) A professional education is organised in almost every network with the exception of the Danish Railways and of the A.O.F. Railways (where it is being studied), of the Piraeus - Athens - Peloponnesus, of the Norwegian (question being studied) and of the Damas-Hama (Syria) Railways.

The importance given to this education differs from one network to the other : it is sometimes limited to courses for apprentices or for determined categories of agents (« mouvement », security, managing civil servants. etc...).

An organisation remarkable for its development and its extension must be mentioned in the S.N.C.F. and a less important one in the S.N.C.B.

The Railways of the Tuskish State must also be mentioned as they even pay the university studies of about 50 of their agents.

— This education is generally reserved to the agents (children of agents get sometimes a priority for the apprenticeship schools).

— The education is free in all the Railways where it has been organised and is covered by the Administration.

— A few particulars only have been received as regards the importance of the expenditures. (They reach 8 million Belgian francs in the S.N.C.B. and over 2 milliards in the S. N. C. F. (French francs).

— The personnel participates generally in the organisation and the good working of the professional education in the same measure and in the same way as they participate to the management of the other social activities.

In several Administrations however, the organisation and the good working of the professional education is under control of the Administration.

— Numerous Railways grant scholarships or support to gifted children of agents in order to allow them to continue their normal or higher studies.

— Some Administrations do not give facilities to children going to school. Others in greater number give school tickets free or much reduced to children of agents — some Railways even grant similar privileges to the mother who takes her child to school.

9) In fact there are canteens; kitchen, or meal rooms in almost every Administration. Some of them sell at cost price but most of them however get a certain support, more or less considerable, from the Administration.

Sometimes even, meals are distributed free.

Usually a certain number of customers is necessary to justify the installation of a canteen.

As a general rule, the Administration supports them with subsidies or in providing free : the premises, the heating and lighting systems, the first equipment. Often too, the personnel on duty in these canteens is paid by the Administration.

The management organisation varies; sometimes the Administration manages, either unilaterally or with the cooperation of delegates of the staff, these canteens or kitchen; sometimes all the initiative is left to the personnel who establish and manage by themselves the organisms they have founded. There is however a certain control by the Administration of the financial point of view, as of the food point of view.

— There are sales counters in the State Railways of Finland : co-operatives or joint stock companies founded by the railwaymen; in the S.N.C.F. : selling counter which is given financial autonomy but treasury is dealt with by the S.N.C.F. Beside, a cooperative (Fédécoopérail); in the R.A.T.P. and in the Algerian Railways: co-operatives; in the Tunisian Railways : counters managed by the Railway; in the F.E.A. and F.W.A. : co-operatives with no intervention of the Administration; in the Franco-Ethiopian Railways and in Indo-China : sales counters and special markets — management split; in the State Railways of Greece : co-operatives entirely independent; in the Piraeus-Athens-Peloponnesus Railways : co-operatives; in the Luxemburg Railways : counters managed by professional organisations; in the Portuguese Railways : sales counters managed and run by the Railways; in the Turkish State : co-operatives managed exclusively by the staff.

— In nearly the totality of the Railways, the personnel obliged to sleep out for service reasons has free accommodation in dormitory or individual rooms. In certain places the rooms available are given against a small rent to agents whose absence lasts more than 12 hours. In several Rail-

ways the indemnities for sleeping out are reduced accordingly.

10) The social welfare organised in several Administrations, is being organised in many others (Gafsa, W. Africa and Norway Railways) or does not exist at all (Austrian Federal Railways, Franco-Ethiopian Railways, State of Mozambique Railways, Emmental - Burgdorf - Thun and Damas-Hama (Syria) Railways.

This social welfare takes different forms and has not the same importance from one Railway to the other; the physical and financial supports are in keeping with moral assistance.

— The expenditures are covered either by the Administration or by a special fund itself supplied with subsidies from the personnel and the Administration or by special funds formed and managed by the personnel and which are allotted, or not, subsidies or contributions from the Administrations or other organisms.

No particulars have been given precisely as regards the amount of the means put at disposal of this department of the social activities and no report was made in connection with the receipts.

— Numerous Administrations manage themselves and directly the social welfare for their personnel.

In the S.N.C.B. committees with a parity form allow the staff to participate in the management of all social institutions.

In the S.N.C.F. the organisation and the working of the social welfare are watched closely by the central committee and the local committees of the social activities, where representatives of the personnel are seated.

In the R.A.T.P. the control is assured both by the staff and the Administration.

In the Compagnie Fermière of the Tunisian Railways the staff ensures the management of the mutual societies and of the sports, artistic, and touristic associations.

In French West Africa, the personnel is allowed to make suggestions; in the Colonial Railways of Indo-China, delegates ap-

pointed by the staff work for the security of labour. In the State Railways in Italy the staff participates in the organisation of the social welfare through its unions or by elective representation.

In the Dutch Railways, the management is ensured by the staff with control by the Administration.

In the Swiss Federal Railways the social funds are managed by the Administration but the personnel has the right to intervene.

In the Bernese Alps Railways the management is mixed.

— The social institutions deal in the building of houses, in the improvement of the dwellings already existing and put at disposal of the staff, in health questions for the premises where the work is performed, etc...; in the S.N.C.B. (Belgium, where there are societies for loans on mortgage outside of the social institutions); in the Otraco, in the S.N.C.F. where the programme for the construction of houses is extremely broad; in the Algerian Railways, in the State Railways of Mozambique, in the Swiss Federal Railways and in the Turkish State Railways.

— Supports either monetary or in kind are arranged in all the Administrations. Their amount and their importance differ but nevertheless they do not go over a rather modest limit. Rarer are the Administrations which grant loans of honour ex-dividend or at a low interest. These loans of honour are usually granted for well determined purposes : marriage, studies, misfortune, etc...

Generally there are no special facilities granted for annual holidays.

In several Administrations the staff has organised privately, touristic associations (S.N.C.B.; S.N.C.F.; and Italy State Railways).

In Finland, the State Railways grant financial support for sojourn in holiday institutions.

The R.A.T.P. has established rest centres for the agents and their families.

The Italian State Railways organise rest and cure treatments and sojourns.

— Homes for children of railwaymen exist in the S.N.C.B., social cases, weak children, holidays, parity management, small participation of the parents) in the S.N.C.F. (reception, rest, cure, participation of the parents in the expenditures, participation of the personnel in the management of the different committees); in the R. A. T. P. (holidays, children from 6 to 14 years old, 150 francs per day); in the Italian State Railways (sojourn free, children from 7 to 12).

A security and hygienic labour service is working or is being organised according to the law, in the S.N.C.B., in the S.N.C.V., in Spain R.E.N.F.E., in the Finland State Railways, in the S.N.C.F., in the R.A.T.P., in the Algerian and Franco-Ethiopian Railways, in the State Railways of Greece, in the Italian State Railways, in Luxemburg, in the Netherlands and Portugese Railways, in the Swedish State Railways and in the Swiss Federal Railways.

In certain countries the legal system of pensions (retirement, old age, survival, incapacity, premature incapacity) is applicable to the personnel of the Railways. In others only to the auxiliary or temporary personnel, the statutory personnel having its own system. In other countries, the legal system is applicable to the railwaymen but completed by the Administration or by independent funds founded at the initiative of the staff.

The same remarks apply to the question of unemployment insurance, the legal system being however in force in the big majority of the Administrations. In a few countries, there is no legal system of unemployment insurance (Finland, Algeria, Tunisia, Ethiopia, Indo-China, Mozambique, Syria, Turkey).

In France there is no system of unemployment insurance but there is an unemployment relief.

It must be noted that in general the system of unemployment insurance does not apply to the permanent Railway personnel.

11) In a few Administrations the medico-social activity is different. The Red Nacional de los Ferrocarriles Españoles has organised for the benefit of the needy agents, consultations of general preventive medicine, of anti-tuberculosis health, of anti-venereal, infantile, pre-natal health and its social service covers the educational expenses in deaf and dumb schools for children of agents. It also gives toys to children who go to the consultations.

In Finland, the Railways deal with the destruction of vermin and rats.

The S.N.C.F. shows its medico-social activity in different forms either at the initiative of its social services or at that of the agents. In this connection they issue « Notre Métier », professional and social weekly review, the « Informations médicales », useful guides, study booklets and information booklets on the social services and finally an annual diary. A campaign is made for health, prevention of diseases accidents and is organised under different forms. Exchanges of children between French and foreign families are sponsored.

In the R.A.T.P. there are mutual society groups of a real importance : mutual fund of co-ordination to the social insurances — mutual society of the underground personnel — orphans homes of the French Railways — ex-service men's federation and numerous other local organisms.

The Compagnie Fermière of the Tunisian Railways grants indemnities in case of change of residence, the reimbursement of destroyed objects or of objects lost as a consequence of accidents.

— Altogether the present system is satisfactory; most of the Administrations however wish to complete their action and intervention on the medico-social scale and to improve their efficiency without real changes at the basis.

In the S.N.C.B. the social institutions are at present satisfactory to the essential needs of the personnel. The Administration is however studying how to reduce the heavy expenditures, ever increasing, of the unemployment-sickness insurance by putting

an end to abuses without reducing the privileges granted to real patients.

This should hasten the realisation of certain very interesting plans : medico-surgical clinic — convalescent or rest centres — holiday camps — dwellings for the personnel.

The S. N. C. V. wishes to improve the system but is unable to take any steps owing to the lack of financial means.

The S.N.C.F. endeavours to constantly improve its activity already very wide on the medico-social scale. It tries to make its social task mainly educational in order to prevent and avoid difficulties instead of remedying them later or having to undergo the consequences.

In the Algerian Railways and in the Gafsa Railway, the staff wants the creation of a provident fund similar to the S.N.C.F.

The agents of the Piraeus-Athens-Peloponnesus Railways criticize the lack of eagerness of the doctors, of precision concerning dependents and the non delivery of specialities (medical) whereas the Administration reproaches the abusive complicity of the doctors for short absences and the too heavy charges. A general complete turn over is being considered.

On the Italian State Railways, the retired personnel wishes to have the benefit of sickness insurance against payment of a contribution as small as possible.

The Luxemburg Railways consider that the present system is temporary and will be developed at a later date.

P. S. — The reply of the Rhaetian Railways was received after the writing of this report was over. It is therefore impossible to take their Administration into account. However, it may be said that roughly it is similar to the replies given by the other Swiss Administrations, viz the Federal Railways and the Bern-Loetschberg-Simplon Railways, and that they would not make any changes in the conclusions to be made in our special report.

INTERNATIONAL RAILWAY CONGRESS ASSOCIATION

15th. SESSION (ROME, 1950).

QUESTION XII.

What must the importance and the prevailing conditions of traffic be, in order that from the economic point of view :

- a) the construction of a railway line;
 - b) the keeping operating an existing railway line;
- should be useful?**

REPORT

(Austria, Belgium and Colony, Bulgaria, Czechoslovakia, France and Colonies, Greece, Hungary, Italy, Luxemburg, Netherlands and Colonies, Poland, Portugal and Colonies, Rumania, Spain, Switzerland, Syria and Yugoslavia),

by M. LALONI,

Directeur du Service Commercial et du Trafic des Chemins de fer italiens de l'État.

General considerations.

The question concerning the volume and conditions of traffic required to estimate the usefulness from the economic point of view of constructing a Railway line or of keeping operating an existing Railway line has roused great interest amongst the European Railway Administrations and particularly amongst those managements who, on account of road competition, are examining the problem of keeping open or closing down certain existing lines. Consequently, the problem has been studied from an entirely economic angle, without neglecting, however, other secondary considerations (political, social, military, etc.).

Whilst leaving it to the Special Reporter, who will have examined the replies secured from the English-speaking Railway Administrations, to develop the conclusions to be

submitted for decision by the Congress, we will attempt to summarise and to comment on the answers received from the French-speaking Railway Administrations.

Very few Administrations have given detailed answers to the questionnaire, but having understood the meaning and the object of the enquiry, they have tried to make the task of the Reporter an easy one. Amongst the Eastern European Administrations, some did not reply (Poland, Rumania, Hungary and Yugoslavia) and others (Bulgaria and Czechoslovakia), while answering the invitation of the Reporter, limited their replies to general and non-committal statements.

Out of 81 Administrations, only 37 replied. But it may be said, in view of the size of systems concerned, that those who did reply are by far the most important.

However, the enquiry should still be pursued, not only to obtain quantitative data, on which it is difficult to draw a conclusion, but in order better to understand the technical, economical and statistical elements about which questions were asked, but to which replies were inadequate owing to the general lack of a rational method of keeping data.

The first question before us is whether it is possible to estimate the volume of traffic which ensures the efficiency of a line or of a network of Railway lines to be constructed or already in existence? And what value can such an estimation have in the case of other countries?

It is evident that such an enquiry offers an interest only in the case of Railways which have their own economic existence and are financially independent of the State Treasury.

Put in this light, and disregarding competition, the basic factor for the solution of a problem of this kind, is the volume of traffic of the geographical area concerned in a specific Railway connection (existing or projected) and capable of creating a flow of traffic under financial conditions which make the operation a paying proposition.

The outstanding question is that concerning the general costs (fixed charges) affecting return of the initial capital outlay.

It is easy to deduce that the cost of construction, subject to technical variations, can influence the operating budget to so great an extent, that it is difficult to fix in a single figure the volume of traffic necessary to estimate the advisability of new constructions from the economical point of view.

But the problem of the economic requirements for deciding the building or the retention of a Railway line, arises primarily from the possibility of resorting to road transport, which obviously gives rise to increasing difficulty.

In order to arrive at a conclusion, an

estimation should be made of both the cost prices by rail and by road, by dividing the constant and variable items with which each is made up. Other difficulties then come into line, for the conditions of operation and output are not equal, and in each country there are State charges and cost prices which differ according to the various policies adopted by the State towards road traffic.

We have thought it opportune to make the above remarks in order that too great expectations should not be placed as it was hoped for when the question was drafted.

The replies received can be considered satisfactory only where they refer to the conditions necessary to ensure economically sound operation. The same cannot be said however concerning the quantities of traffic to be determined. Moreover, it is not easy to gain an accurate idea of the percentage of lines in the various countries which have lost their economic equilibrium and of the other lines which must be kept in operation solely for reasons of a general interest and which, therefore, require in one way or another the constant assistance of the Treasury of State.

As a conclusion, before examining the various replies made to the questionnaire, we may say that the majority of the French-speaking Railway Administrations are unable to estimate the output and the operating costs of the lines forming their system. Accounting and statistical records are insufficient for this purpose and do not permit quantitative estimation of the volume of traffic (passenger and goods) necessary to balance the budget.

As will be observed further on, a few Railways only (French, Belgian, Italian, etc.) have had the opportunity of making indirect estimations and of determining in a very approximate manner the amount of traffic necessary to justify the keeping operating or the construction of a Railway line.

But it must be recognised that the pro-

blem is bound up with a number of other considerations which are indicated and commented in the replies, which we have examined.

I. - Keeping existing lines in operation.

Question 1. — *Taking into account capital repayments, does your operating budget show a deficit for the last two years, as well as for the five years prior to 1939.*

The enquiry as to the limits of usefulness from the economic point of view for constructing new Railway lines and for keeping existing lines operating has taken the form of a study of the financial results obtained by the Railways in 1947 and 1948 and during the four financial years prior to 1939.

The problem of deficient lines arises through its effect on the financial reconstruction of Railway undertakings.

Where the position of these undertakings is worsened by the unfavourable conditions of the transport market due to road competition, there arises a problem of bearing the economic weight for the whole of the lines, which on each system, gives rise to operating difficulties.

It is true that the question of retaining lines with a low traffic arises precisely where the total returns of a system are unfavourable and, consequently, any makeshifts are tried to improve the situation.

From the answers obtained, it appears plainly that already before the war the financial conditions of Railway undertakings were not satisfactory and that after the war, owing to the technical problems in rebuilding and reorganisation, and the well-known and serious problems of the economic reconstruction in the various countries, these financial conditions have worsened.

The budgetary returns of each system are too heavily affected by circumstances beyond the control of the Railway managements, particularly the state of develop-

ment of the economy and the different policies adopted by each country where competition is concerned, as well as by the individual position of the Administrations (organisation, level of technical improvements, etc.) and especially by the lack of planning in construction of Railway lines of different traffic densities. Hence the impossibility of forming a general opinion. However, it is a fact that the Railways as a whole find themselves to-day in a financial position which is far from prosperous and that amongst the various systems it is the more important Railways which show the most difficult situation.

Question 2. — *Who met the operating deficit? What amount is carried by the State? What rating policy does the State impose on you?*

Operating deficits have always been carried in one manner or another by State intervention, the terms of which have depended as a whole on the financial organisation of each individual Administration, and on the rules governing, for each system, the complex matter of financial relations between Railway and State.

In certain particular cases, loans have been resorted to, but evenso, it is the State finally which has assumed responsibility for them and which has guaranteed their reimbursement.

The Railways' increasing financial difficulties and in consequence the increase of the charges to be carried by the State have revealed, in each country, the great strain imposed on each Railway Administration in order to comply with the tariff policy adopted by the State, according to the prevailing conditions in each particular country. In no country are the Railways free to act in the matter of tariffs according to the market position or by inspiring themselves exclusively from economic considerations.

Although this situation always existed, the burden to be carried became heavier after the war for countries where money

devaluations took place and where resistance is met against the levelling up of transport charges to the new rate of costs increased by changes in currency values.

Therefore, it may be stated that the budget of each system is augmented by the burden of political and social factors, in view of preoccupations to fix Railway tariffs in relation to the economic reconstruction of the country, the cost of living and the general stability of prices.

Question 3. — *Do you collect statistical data to determine the amounts of traffic on each of your lines? What methods do you follow in the case of passenger traffic and goods traffic? How are your lines distributed amongst the various categories of traffic density adopted by you?*

The problem of lines with a small volume of traffic raises first the question of determining which are those lines, i.e. the study of the methods to classify the lines according to the proportion of traffic carried on each of them, or to establish the division of the whole of the traffic over the lines of a certain network.

Of course, the above question is not so important for systems of moderate length, in particular if experience confirms that the traffic density may be considered almost homogeneous on all the lines. On the other hand, the question becomes more and more important as the extension of the lines is greater and the sections are more entangled. But the difficulties and the complexity of an enquiry on the concentration of traffic increase when passing from a small Railway to a more important system.

The enquiry made as regards methods to obtain the determination of the density of each line has confirmed that the lines followed for this type of statistical recording are not homogeneous. Not only do the recording methods differ, but also the units by which the statistical data are expressed. In general, these results are indicated in passenger units and tons, but

by the Italian Railways, for example, these data are subsequently converted into receipts per kilometer, the passenger and goods traffic being afterwards converted into Liras on the basis of a single average revenue computed for the whole of the system.

Even the frequency of the recordings in question differs notably from one system to another. In fact, certain Railways make their statistical returns in a systematic and regular manner, whereas others limit themselves to soundings over very short periods, one week for instance, and in different seasons (Winter, Summer, etc.). Minor Railways have the possibility of making their records direct on the basis of the receipts collected by their stations, whereas the important systems have to adopt methods with a view to obtaining data from the traffic affecting each line.

As a general rule, the particulars for goods traffic are obtained by perusing train waybills. For passenger traffic, they are obtained from the statistics on the passenger traffic of each train, combined with the service schedule of the trains for each line. In the old days, data were collected from the stations, based on the number of tickets issued for various destinations and possible itineraries.

Bearing in mind the different requirements of each Railway on the problem of determining the traffic density, we think this question should be put on the agenda of the Railway Congress or the U. I. C. for a more complete study, or to secure, if possible, a uniform method of recording and of measure units, according to the lines. Furthermore, there may be isolated cases where improved results could be obtained by means of the « Hollerith » system.

Question 4. — *Do you also collect statistical data in order to ascertain fluctuations in the traffic at different times of the year, on different days of the week, etc...? Do your statistics enable you to establish the degree of concentration of the traffic on the different lines, taking periodical fluctuations into account?*

When the question was raised of the statistical organisation enabling to establish the degree of concentration of the traffic on the various categories of lines, it was also asked whether records are being taken in order to determine the figures of the fluctuations during the various periods of the year, month or week. It was also asked whether data were kept to determine the density of traffic for each line, by combining systematically the two enquiries in order to ascertain what traffic affects a line during an annual period or during a particular period of the year, or the week, etc. In fact, by establishing such records, a line with low traffic density results as compared with the annual traffic returns could very well be used for very heavy traffic at a peak period.

Replies received, whilst in general very uncertain, enable us to draw the conclusion that the census in question is not carried out systematically and for all branches of the Railway activity.

On the other hand, there seems to be a tendency to be satisfied with certain statistical soundings, from time to time, according to the aim to be reached.

Question 5. — *Do you set out separately the costs and receipts for each of your lines, in such a way as to establish partial budgets for each line?*

The problem of the output of the lines arises, not only in relation to the volume of the traffic concentrated on every one of them, but also in relation to the prime cost affecting each line. Consequently, the various Railway Administrations were asked whether they set out systematically the costs of each of their lines, in order to make it possible, by comparing these figures with the revenue accruing to a line, to draw up a balance sheet.

As was expected, the census of costs is even less frequently taken than that of the receipts. However, having their attention drawn on low traffic lines, almost all the Railways have carried out, or will

carry out from time to time, specific enquiries to arrive at the determination, during a certain period, of the economic situation of different groups of lines. These enquiries are made specially for low traffic lines, for which the problem will be examined of replacing them eventually by road transport, or even of closing them down altogether.

Question 6. — *Have the above mentioned statistical data enabled you to determine the class of lines the amount of traffic of which has an adverse effect on the financial stability of your Railway system as a whole?*

Generally, special tests instead of a systematic census have enabled the various Railway Administrations to establish which are the lines having an unfavourable influence on the budget equilibrium on the whole system by reason of low traffic density, combined with the minimum cost of their operation. However, the Administrations have not given the data specifying what portions of each system show favourable or negative results. The French National Railways only have reported the results of a special study on the minimum goods traffic required to ensure a budgetary balance between receipts and total expenditures. For information, the French Railways state that on lines served by steam trains the minimum traffic should be from 75 to 80 t per km.

Needless to say, more detailed data would have been of great value in connection with this enquiry, as this problem affects the economic reconstruction of the systems in a decisive manner.

Question 7. — *Amongst the lines showing a deficit, what is the approximate percentage of lines which it is necessary to keep in operation:*

1. *For technical reasons (exceptional traffic on the main lines, interruptions in the normal routing, etc...);*
2. *For economic reasons special to the operating company;*
3. *For political, social, etc., reasons.*

An enquiry on the limits of usefulness to keep deficient lines in operation only applies to those which could be closed down without adverse effects either on the technical arrangements of the whole of the system or on the economic equilibrium of the region served.

From a technical point of view, the following distinctions should be made:

a) the lines which, although showing a deficit, are strictly integrated in the whole of the system to such an extent that their cancellation could not be done without adverse consequences for the Railway Administrations;

b) the other lines whose suppression would not involve similar consequences, and for which the balance between maintenance in operation and closing down can be struck separately, taking into account the economic results of either solution. The connection between a line of low traffic density and the whole of the system can be considered from a strictly technical point of view (lines destined to strengthen, during a certain period of the year, the main lines of direct conveyance of the traffic; emergency lines in case of interruptions on the main lines, etc.). This group of lines must be separated from the lines which do not fulfil this purpose.

To implement this enquiry, it would have been interesting to possess sufficient statistical data as to how the question presents itself to each Administration concerned in relation to the technical aspects.

Unfortunately, the same remark made with regard to inadequate data on the concentration of traffic and on the position of deficient lines, applies to the determination of the lines which should be classified as one or the other of the above groups.

In view of the fact that replies on this point were evasive, except for the small systems, we agree in general that when making a decision on the eventual suppression of lines showing a deficit and unfavourable economic conditions, it is necessary to weigh up the links of a line to

the whole of the traffic, taking into account that lines may be necessary for strictly technical in addition to economical reasons. It should also be considered that operating conditions may be improved above all with the aid of light transport means.

The various replies to the questionnaire agree when stressing the considerations of a general economical and political order which are bound up with the closing down of Railway services on lines of small traffic density, and when pointing out the consequences such a decision might have on the economy of the districts and countries served by these lines.

Question 8. — *Are you of the opinion that a more adaptable rating policy or a different form of operation and organisation of the lines showing a deficit would improve their present financial situation? Do you think it might be advantageous to suppress one or other service?*

As far as deficient lines are concerned, a wide field of investigation is open to technicians and economists to study methods to improve the output of these lines, so that their operation may be more economical and their maintenance no longer a burden of a lesser burden on the financial turnover of the whole system. Most of these methods concern reduction of costs. However, measures to secure an increase of revenue must not be neglected. In this respect, the following point arises:

Can a more flexible tariff policy improve the conditions of low traffic lines?

Few Railways gave a positive reply to this question, but they stressed the difficulties of this policy on account of limitations on the freedom to fix the tariffs. Most Railways have a negative opinion on this matter. They doubt that it would pay for a country to make a tariff discrimination according to the lines, as this would destroy the advantage of tariff uniformity for the whole of the country, uniformity which in the past was considered so beneficial and assisted in the development of

the Railways. Some managements also query the usefulness of creating tariff differentiation in view of the unfavourable economic conditions of deficient lines. In fact, the expenses of these lines would lead to tariff increases, but in this case serious consequences are to be feared for the traffic on account of heavy competition of road transport. Moreover, the opinion of many is that a worsening of the present situation would follow.

The preponderance of heavy constant expenses, typical of rail service organisation, makes one doubt the opportunity of eliminating one or the other branch of Railway operation, even if certain Administrations have replied that certain benefits would accrue thereby. But in this case the passenger services seem indicated to be replaced first of all by road transportation.

More confidence is held in the advantages derived from technical improvements: use of railcars, special running systems, more economical methods of issuing tickets, of keeping station accounts, etc.

A remark worth recording is that it is not economical to apply to low traffic lines the same regulations as adopted for the more important lines. This seems to be a question which may attract the attention of experts, as its study appears likely to yield good results.

Question 9. — *Do you consider that lines at present operated by different companies or Administrations could with advantage be regrouped reorganised, divided up, etc...?*

Bearing in mind that the Railway systems are not in all countries run by one organisation, subject in one way or another to State control or operated direct by the State, it was thought useful to ask whether the position could be improved by merging with other Railway undertakings different from those to which they belong at present. Such a process took place in the past (the history of all Railways is full of mergers and reorganisations) and could still give rise to further develop-

ments. Replies received are naturally affected by the situation of the various countries, but the general trend is that the problem should not be considered. Certain Railways, however, have indicated that an organisation different from that at present in force would offer certain advantages. In this respect, there appears to be a clear difference of opinion between those who propose a process of centralisation, under chief control of the major organisations, and those who consider that certain lines, at present operated by large Railway concerns, could be more economically run under private ownership.

It is not possible to draw general conclusions on this problem. All that can be said is that in future it will be the object of special solutions based on the different conditions prevailing in each country, outside the various economical and political conceptions.

Question 10. — *What is the policy of the State as regards protecting the Railway against road competition? (Please give the measures adopted by the State in order to prevent the Railway losing their traffic and the progressive depreciation of the capital invested in them).*

Question 11. — *What are the financial effects of road competition on the Railway?*

Indirectly connected to the question of low traffic lines is that of the policy of the State with regard to road competition and its consequences for the Railways.

As previously mentioned, the problem of deficient lines has been aggravated by the worsening of the general economic structure of the systems caused by competition. As other international unions are making a detailed survey on the steps taken by the various countries to curb road activity, we may refrain from giving here analytical particulars of the rail/road problem in each of the countries concerned. The general trend of opinion, however, is that the present position is unsatisfactory and worse than pre-war, that the financial effects of competition are really serious,

either with regard to the quantitative loss of part of the traffic or to the loss of traffic which might have yielded higher receipts.

None of the Railways have been able to state concretely what the repercussions are of road competition on the activity of the Railways. They are certainly serious, which confirms once more that the question of road competition is of vital importance to the recovery of the Railways and, therefore, is worthy of the highest attention of the various Governments.

Question 12. — *What is the present (and the pre-war) average cost per passenger/km and ton/km carried by the Railway, including sinking fund charges? What method do you follow as regards this sinking fund?*

Question 13. — *What are (and what were pre-war) the costs of road transport taking into account capital depreciation?*

Very attractive is the question of comparing the cost price per unit of traffic carried by rail and by road, together with the fluctuations of this cost price in the past by reason of technical and organisational progress on both transport systems. There is also the influence on the average cost price of a system of the existence of deficient low traffic lines.

For these reasons and in order to attempt making useful comparisons from the data supplied by the various countries, the latter were requested to give information on the cost price by rail and by road per passenger-kilometer and per ton-kilometer, before the war and in 1948. It is no doubt difficult to be precise in this matter, seeing that the Railways do not all work out their cost prices in a systematic manner. They do not all segregate their expenses per passenger/kilometer and ton/kilometer. The methods followed to compute the financial costs and sinking fund charges are also very different. Moreover, the conditions of road operation are extremely varied.

In order to arrive at any cost price

figures, within a certain time, it is necessary to make evaluations, according to methods adopted, of the distances covered within a unit of time, of the average frequency (for passengers) and of the average load and average utilisation in both directions of the traffic (for goods).

However, one important remark may be made from the few replies received on Railway and road expenditure: i.e. the estimated cost of road operation is higher than the average cost of rail transport.

On this subject, one exception concerns Italy, where recent estimations show that the cost per passenger/kilometer and ton/kilometer became higher after the war than the corresponding costs by road, this being due to different price adjustments (rail costs increased 50 times or more over expenditure in 1938/39, whereas by road they increased only 25 to 28 times).

Interesting observations could be made by comparing the present cost prices of road transport in different countries, but as data obtained on the subject are incomplete, the question should be left open for further survey, which could be undertaken by international organisations interested in transport.

Question 14. — *When the road costs are the most favourable, have you considered suppressing Railway services?*

The problem of eventual substitution of deficit showing lines has been considered by almost all the Railways. Some of them have only studied it, whereas others have already made replacements by road services. The various replies, however, leave the impression that investigations on this question should be pursued. Whilst there is a certain reluctance to recognise that the purpose of many secondary lines is now obsolete and to admit that their maintenance in operation is often uneconomic, it is agreed that in future their transformation should be envisaged.

The more important Railways state that they have plans in this connection. It

would be difficult to give a general opinion on the adequacy of the measures proposed and as to whether the financial conditions of the Railways and the comparison between both cost prices (rail and road) should not require more action. In any case, the proposal that an analysis and theoretical examination should be made of the reduction of expenditure on the passenger and goods services by the closing down of secondary lines, appears to be a timely one. A similar enquiry should be made into the actual operating cost of a Railway service when another one has been cancelled, for this cost should be referred to when comparing the specific cost of a replacement service covered by road means. As one Administration pointed out, the comparison of costs is subject to differences in both services, either in the legal and financial structure particular to each service or in the level of the remuneration of the staff.

Question 15. — *What advantage would it be from the cost point of view for the Railway to give up all the lines showing a deficit? Do you consider that the Railways might be able to meet road competition in this way without any other protective measures?*

The first question to be examined when considering the problem of closing down deficient lines is whether the financial benefits derived from such a radical step would be important and liable to exercise a definite improvement on the average operation cost computed for the whole system, in order to affect decisively its relation to the cost of the corresponding unit carried by road. Obviously, the possibility for this decision to carry out its effects in one way or another depends on the part played by these secondary lines, on account of their low traffic, in the whole of the system. It also depends on the present state of their operating organisation and on the ratio of economies one expects to realise, as compared with the loss of revenue caused by abandoning such Railway lines. Needless to add that the

benefits to be expected from these measures will be the higher when the comparative position of the average costs of rail and road services will be less unfavourable.

The reply to the question whether by closing down deficient lines a remarkable advantage could be obtained, is given by the information set out in the previous questions concerning the percentage influence of low traffic lines on the whole system and the technical and political reasons which have so far made it advisable to keep them in operation. When there is a prevalence of lines built chiefly for purposes of general interest, it is not easy to decide on their suppression and, in view of the serious position, isolated measures would not be sufficient to bring forth a definite improvement. On the other hand, when the above reasons are non-existent, the proposal of closing down low traffic lines may be more easily contemplated. But, in this case, the position may not be so serious as to admit that only the cancellation of deficient lines would alter decisively the present state of affairs.

In a general way, one may conclude that the results of such radical measures would be very small and that there is a doubt on the extent to which it will be possible in future to suppress the operation of these lines, which may be of a minor importance.

In the midst of all these uncertainties, it is difficult to fix the rate of improvement in the average cost of Railway operation to be derived by applying this method. For this reason, without excluding the possibility of an amelioration, one may affirm that there is a general conviction that other measures should be contemplated, within the framework of the policy on transport followed by the State.

On this subject, we may add that everywhere equality of conditions and obligations is claimed for both rail and road services. Certain Railways consider this equality as prejudicial in the determination of the advantages of the two systems of transport. Moreover, some systems appear

to consider protective measures in order to meet road competition. This is what they term a coordination policy, including arrangements to avoid the inflation of means of transport.

The abandonment of rail traction on low traffic lines no doubt improves the working cost of the whole system, but it is difficult to estimate the rate of this improvement. When replying to the question, certain Railways (France) supplied interesting data representing a significant index of the degree of operating economy, in particular figures of the average staff employed on the traffic lines (heavy, medium and low). This produces an element to consider the position of low traffic lines in France, which is not so serious as might be thought, and convinces us that further improvements in the operation regime of the Railways in that country may adjust the difference in the output between deficient and other lines.

But such judgment, which may be applicable to some Railways offering certain characteristics would no doubt, be different with regard to Railway Administrations finding themselves in a worse position.

In Italy, for example, the discrepancy to-day between the average cost of rail traction and conveyance by road is explained by the predominating part exercised by low traffic lines on the whole of the Italian Railway system, but in spite of this the comparison between the two costs appears to be more favourable than that on other Railway systems, if abstraction be made of the negative part of the Railways. Before the war, rail traffic in Italy was concentrated for 80 % only on one third of the system, for 15 % on the second third and for 5 % on the rest.

Question 16. — *What consequences would the possible suppression of the deficit showing lines have on the main line traffic? Up to what point would these consequences justify maintaining part of the deficit showing lines in service?*

Admitting the possibility of closing the deficient lines, i. e. by supposing that all obstacles can be overcome on the technical, political, military, social side, etc., it may be feared that part of the traffic of these lines would be lost instead of going to the rest of the system. An adequate solution of the problem of operating the replacement lines could reduce this loss, but the remainder of the system would be affected by a loss more or less important of traffic, either for technical reasons (necessity to tranship) or for motives of a psychological or economical nature.

Many doubts have been expressed on the estimation of this loss and on the assumption that the remedy of closing these lines would be a paying proposition. As a matter of fact, it is thought by one Administration that the preoccupation of losing small sources of traffic would completely discourage a vast cutting down of a railway network. According to others, this preoccupation in itself would never have any decisive value. Very interesting in this respect is the evaluation made by the French National Railways, who think that the loss of revenue may be about two or three times the expenses of the line to be closed down. This view confirms the doubt as to the advantage of suppressing certain lines, either for the regions served or for the budgetary balance of the system.

In addition to these extreme opinions, there are others with more intermediate views, but most Railways consider it difficult to settle this question with a general conclusion, and they consider that each particular case should be subject to a separate examination. It is just the same with regard to the other conception according to which the loss of traffic would be light for the passenger traffic and heavier for the goods traffic, on account of the frequent necessity to tranship or change from one service to the other; on the other hand a consignment of goods, collected at origin by road must be often regarded as lost to the Railway, who should have normally to continue the conveyance from a certain point.

Question 17. — *In what way do you think it would be possible to divert to the main lines the traffic from deficit showing lines which it has been decided to abandon? Should the Railway itself operate these road services? If so: directly or by means of an affiliated company under its control?*

If all Administrations agree on the fact that the closing of lines would entail a loss of traffic (passenger or goods) for the rest of the system, there is a general opinion that it should be possible to make some arrangements in order to reduce this loss to a minimum, if not to cancel it out completely.

All systems are of the opinion that the Railways should not lose interest of what may happen after servicing of deficit showing lines has been abandoned, and they insist on the fact that the road services replacing these lines should be maintained under Railway management. Some disagreement may arise with regard to organisation of these services. Would direct operation be preferable, or contracting out to separate undertakings, or operation under control of parent companies affiliated to the Railways? Obviously, the solution differs according to the organisation of each system, the existence of transport companies financed and controlled by the Railways, the extent of sponsorship one is prepared to allow private undertakings, etc.

It is worth pointing out that all managements are unanimous that a rigorous control should be exercised by them on the replacement road services. This may be interpreted as a distrust of the general policy of coordination of transport and of the action that the authorities dealing with this problem are taking on the subject.

Certain Administrations have also raised the question of tariffs to be applied for these services, considering that they cannot be the same as by rail. On this subject, see Question 18.

Question 18. — *Do you consider that the arguments generally brought to bear against clo-*

sing down deficit showing lines could be refuted if the Railways organised corresponding road services, covered by the same legal regime as railway services, and if they adopted the same rates and granted the same reductions?

Experience shows that where replacements of Railway services are contemplated, in order to make operating economies, there is a strong opposition from the populations served and the organisations representing their interests. Notice should be taken of this resistance, but the operation of road services by the Railways themselves and application to them of the legal regime (obligation to carry, parity of treatment, etc.) governing the Railways and, also, if the extension to the replacement line of a low traffic line of the Railway tariff system would perhaps overcome the above opposition, whilst enabling the Railways to make their operating economies.

Replies received confirm that in these circumstances no resistance should be expected and that it would in any case be overcome. However, for goods services, the replacement by road entails transshipment at the railhead where the road links up with the rail, and this circumstance alone may give rise to dissatisfaction in spite of the fact that the Railways agree to the application of the same legal obligations, tariffs, etc.

This point should be noted, especially with regard to particular lines carrying bulk traffic, but the Railways could undertake the transshipment or provide the necessary facilities if concrete results are thereby obtained. This should, therefore, be taken to account in addition to the other elements affecting this problem. There may also be climatic conditions preventing the replacement by road transport. Certain observations should also be made on the question of tariffs. Doubts have been formulated on the possibility of applying to replacement lines the tariffs in force on the Railway. In this respect, the difference in the ways and means, costs, etc., of both transport systems have been pointed out.

In fact, we think that it must be recalled here that the original purpose of this survey is to examine lines affected by unfavourable economic conditions on account of their very low traffic. In these conditions, the comparison of the means cannot be made on the average cost of the whole system, and certainly not on the paying part of the system, but on the specific costs of the group of non-paying lines.

Therefore, it should not be excluded, at any rate in theory, that if these sections are to be serviced, it is advisable to use road means at tariff conditions which may appear inadequate if replacement is the only way of cutting down the loss. To conclude, it is evident that the limits within which these considerations carry a certain weight cannot be determined, but the advantage of resorting to these methods should not be excluded.

2. - New lines.

Question 19. — *Have any new Railway lines been built in your country since 1944 (if so, please give the length, operating regime, purpose, etc...)?*

Question 20. — *Are any lines under construction or proposed? (Please give the length, operating regime, purpose, etc...).*

Question 21. — *If the answers to questions 19 and 20 have been in the affirmative, please state if the construction of these lines was decided upon for economic or other reasons.*

Question 22. — *Have considerations of general and national economy had a predominating influence, apart from the expected returns of the undertaking? What motives of national economy led to the new lines being built? What financial returns are expected?*

The requests sent to the Railways for data on the construction of new lines have been preceded by enquiries on the new lines built after 1944, on those under construction and on the sections at present projected. In regard to the latter, we have tried to ascertain what are the ends it

is hoped to attain by their construction. From the replies received, it results the fact, already well-known, that the stage of large extended building should be considered as terminated. Lines of minor importance (sometimes single branch-lines) have been opened or are under construction. Where more important lines are concerned, considerations of a political and social order and of general economic development have been decisive, to such an extent that it is not concealed that some of these lines were already considered from the outset as likely to show a deficit.

On the other hand, the systems already built carry traffic imposed by the geographical conformation of the countries and on no system is there a shortage of long-distance lines or an existence of large sources of traffic which the Railway facilities already provided could not carry.

Question 23. — *With the cost of Railway and road traffic as they are at the present time, in your opinion what volume of traffic is necessary if the construction of a new railway line is to be a paying proposition, taking into account interest on the capital invested?*

On the assumption that the sole purpose of this question is the determination of the minimum traffic required to make the construction of a new line a paying proposition, we may conclude that the enquiry has failed, for all the replies were inadequate. However, the Reporter does not think that a pessimistic conclusion should be drawn, for it is very difficult to produce figures of minimum returns, expressed in passengers, tons of goods, axles or receipts.

The views which we have summarized on the problem, although it is impossible to translate them into figures, have induced the Administrations to examine the problem of the burden of deficit lines on the financial returns of the systems. The delegates attending this Session of the Congress will no doubt want to think this problem over.

We may say that information received on the minimum returns required for the construction of a new line refers to certain small systems only and therefore cannot be of any general value.

We all know the many factors on which depend the traffic accruing to a line and how many differences there may be between one or another Railway construction. Therefore, we do not think it advisable to report on the replies received, as almost any one of them have stressed the difficulty of supplying general particulars.

Besides, as most new Railway constructions are terminated and the few sections projected or under construction are of a special character and of an extra-economical purpose, we may conclude that the Railway Administrations have not for some time devoted their attention to these problems. It is also worthy of note that the shortage of information on new constructions is parallel with very important considerations on the closing down of deficient lines.

Question 24. — *What methods can be adopted to determine the probable traffic on a new Railway line, supposing that sufficient statistical data are available concerning the economic situation of the district concerned? To which statistical data do you attach the greatest importance?*

Trials have been made to set up a method for the determination of the prospective traffic of a line requiring construction.

It is difficult to say to what extent these attempts can be of general use and extended to other countries. It is also difficult to judge what have been the strictly particular features of the line for which an advance survey of its possible volume of traffic was made.

Railway Administrations have been approached for their opinion on this question. Their replies confirm a general distrust of these methods. The problem seems somewhat outmoded and this may

account for the reluctance of experts to enquire into the subject.

All those who made a recent survey of the question of lines under construction or projected, give very vague information on the statistical sources used by them.

Population statistics of the towns situated within a certain radius of a line (but which radius?) are one of the chief items of the computation. It is also useful to peruse detailed statistics on the composition of this population, its various business activities, distribution of incomes, etc., elements which may enable comparisons with corresponding data for other areas already served by rail.

On the goods traffic side, the survey should be directed principally on the industries already in the zone, by sending out questionnaires, etc.

Where the problem is combined with a plan of economic development, future conditions which will obtain when the period of improvement is terminated, should be borne into mind, more than the present conditions, i.e. by taking to account the areas which will be under cultivation in the future, the future output of local mines, etc.

Here also, it seems useful to gain from all these elements some data for a comparison with the position of regions which have reached a similar degree of economical development and for which the statistics of traffic accruing to the Railway are already known.

Question 25. — *What characteristics of an important traffic, concentrated in given periods of the day, week or year, in your opinion would make it necessary to build a new Railway line?*

Question 27. — *Are you of the opinion that road transport has already reached such a stage of development that it can deal with transport in bulk?*

When speaking of the minimum volume of traffic required to ensure that a new line be a paying proposition, a distinction should be made: is this traffic going to be a uniform one or a peak traffic (even

with minimum limits) during certain periods, because a new Railway construction may render itself inevitable if the traffic has the characteristics of concentrating at certain hours of the day, certain days of the week, or at regular periods of the year. In these cases, a technical problem may arise which, taking to account the actual conditions and apart from any economic consideration, may decide in favour of a new Railway construction in order to supply communications to an area unprovided with them.

This point of the question is bound up with an estimation one may make of the capacity of road haulage to cope with bulk transport. Whilst recognising that road operation has made remarkable economical and technical progress, on the passenger as well as on the goods side, we all agree that it cannot yet be placed on the same level as the Railways where coping with very concentrated traffic is concerned.

The conveyance of large parties of workmen directed to a big town, an important flow of agricultural produces, etc., may warrant new Railway constructions, even when massive road transports are on the increase.

Only in a few cases do deciding factors derive from technical considerations. On the whole, they concern exclusively the question of cost prices. Here should be recalled the advantages of rail traction, especially in the expenses for motive power and labour. These are elements well known by all, which represent at the present time the factors of any superiority which may still be attributed to rail transport for a well defined field. But let us not neglect the problem concerning lines to be eventually constructed. For the zones at present unprovided with Railway connections, the question should be examined of where and in how many instances the prospective traffic will reach a size to enable the economic factors to manifest themselves.

It does not seem too hazardous to con-

clude that in the present phase of rail development, there will seldom be traffic potentialities so favourable as to warrant an extension of rail systems.

After the experience of war transport, the query as to the technical capacity of road haulage to cope with bulk traffic can only be made from a narrow angle (the transport of workmen has been quoted).

Obviously, the beneficial use of Railway means can only be admitted when there is a sufficient volume of traffic. But there is a doubt that there may still be any zones where new Railway constructions could reach this volume. It should also be added that the Railways are more interested in a regular flow of traffic than in a peak period traffic.

Consequently, without neglecting the remark on the progress of road haulage, minor weight should be attached to the prospective concentration of future traffic, when this factor must come into line to decide on new constructions.

Question 27. — *Taking into account the possibilities now offered by other methods of transport, can it be affirmed that nowadays the construction of new Railway lines is essential to the economic development of a district and backward countries, and that investing capital in this way is the most economic solution from the national point of view.*

As already mentioned, the problem of new Railway constructions does no longer arise in the present phase of transportation development. However, it still exists in backward areas in need of general, social and economic development. In connection with these regions, it may be asked whether in the present position of the technique of transport it can be affirmed, as was possible in the past, that the development of rail transport, apart from any question of financial returns, is essential to promote the progress desired for these regions. This question corresponds to the initial conditions, which in the past

were recognised as justifying the construction of Railways as a necessity for economic progress.

In a sense, the various replies on this point are not divergent, although certain Administrations replied « yes » and others « no » to the question put to them. It should be noted that in such enquiries it is difficult to go outside the sphere of one's own country, and we all know that if there are still backward areas in certain countries, in many others this problem is non-existent. In addition, it is a fact that Railway systems are not everywhere equally developed.

Certain Railways have agreed that they are still in need of new constructions (no mention made here of lines essential on account of impossibility to use the road during a period of the year) and they have referred to projects under review or in process of realisation, stating that the purpose of the construction is purely economical. This statement only means that there are still a few areas where it is convenient to build new lines.

The problem really arises when there are doubts on future developments and on the means to be used, and here crops up the question of preference for one or the other means of transport, taking into account chiefly the different capital outlay for each method and also the different returns of both.

In view of the probability of small traffic returns, particularly during the initial phase of development of the backward zones, the impression prevails that it would be very difficult for Railway constructions to represent the best investment of capital destined to improve communications.

Leaving aside the potential use of this capital for other economic activities or the improvement of other public services, one may consider these days that the transport by road is an economical proposition to break down the barrier of isolation in which these areas and their population find themselves, leaving to a later period, when a strong economic development will

have set in, the examination of the investment of big capital for the development of the rail system.

Question 28. — *If so, what form of management should be set up? How should relations with the State be regulated: either as regards the financial needs of the new lines, or as regards subsidizing the future operation of these lines if necessary?*

When new Railway constructions are considered essential in order to favour the economic development of backward areas, the problem arises as to the form of management to be preferred, and the regulation of the relations between the managing Administration and the State, regarding the outlay expenses or the possible working deficits.

With regard to management, the more widely expressed view is that these lines should come under control of the State, who operates most of the systems. One opinion, however, has been voiced in favour of private management, thought to be more economical.

The few answers given on this subject are too limited to the conditions obtaining in each country and to the present legal regime of the Railway Administrations, whereas the problem is in our opinion, to ascertain whether a different form of management for the lines constructed within the development scheme of backward areas, would not reduce the adverse returns to be expected from these lines.

As to financing the construction, the purpose itself of the new lines points to the necessity of State intervention. In connection with this question, certain Railways have taken the opportunity of stressing once more the disparity in the conditions set up by the State in a few countries in regard to the rail and to the road, in such a way that the rail must continue to bear the financial burdens from the start of the construction of these Railway lines, whereas the State undertakes directly to cover building costs of the roads used

by road haulage. This is a very important problem, but its importance, outside this present question, bears more on the general principle of parity of operating conditions for the two different modes of transport.

One remark made is that it is precisely when the relations are determined which will regulate, after construction, the operation of a new line that the non-economic character of this construction will come out. We are told that no Railways should be built which from the outset require subsidies. This would show that these lines are expected to carry little traffic only and if such is the case, it would be more advisable to resort to road transport.

Questions limited to those countries which suffered war damage.

Question 29. — *At the end of the war, was an organic plan prepared for the reconstruction of the damaged Railway lines? Were any committees, councils, etc..., set up with this object?*

Question 30. — *Did any differences of opinion arise concerning this reconstruction? In your opinion can it be stated that the decisive influence of the Railway reconstruction policy is attributable to temporary considerations (public works policy, employment for the unemployed, etc...) or permanent ones (recognition of the social value of Railway transport, insufficient evaluation of the possibilities of using road transport economically)?*

There appears to be a certain analogy between the problem of new Railway constructions and that of rebuilding lines damaged or destroyed by the war. At the end of hostilities, the damage on many lines was so extensive as to involve considerable financial resources. Where the lines were already showing a deficit, one wondered naturally whether their reconstruction would be indicated.

Fortunately, not all the countries were struck by the war and those who were not spared did not all suffer considerable damage to their Railways. However, many

delegates attending this Congress are aware how important this problem was during the post war period. Various difficulties had to be fought together, such as general shortage of Railway equipment, insufficient capacity at the time of road transport, necessity of rebuilding simultaneously the permanent way installations, rolling stock, stations, motive power, etc.

The whole problem was often governed by a disproportion between the financial requirements for repairing so much damage and the means immediately available. It was therefore necessary to fix the limits of priority for the reconstruction of the various sectors, and at the same time meet numerous requirements in the economic field, in the midst of serious difficulties of all description which were prevalent during that unfortunate period.

Two factors occurred at that moment to take advantage of the position and center all efforts and available means on the solution of Railway reconstruction, a cause more deserving than any other, by neglecting or postponing any work which was not immediately essential. On the one end was the limitation of financial means, and on the other the circumstance that the interruption of Railway facilities during the war was breaking down the customary opposition of the populations to any project of suppressing the non-paying lines. Viewed from this angle, the moment was favourable to certain Railways, but less so to others. As a matter of fact, political and social difficulties arose which often had a bearing on the decision to rebuild, notably prevention of work stoppage, necessity to provide work for the areas where war had caused exceptional conditions of uneasiness, or worsened pre-war conditions.

From the information given us, it appears that almost everywhere action was taken, constituting special organisms to fix the programme of Railway construction. So far as Italy is concerned, remarks have been made recently on the progress of each part of the reconstruction scheme or of its

extension to the lines showing a deficit. The deviations, which have occurred to the plan, are due more to the prevalence of political and regional considerations than to any failures of the authorities responsible for the Railway branch of reconstruction (Railway Administration and Commission for Rail Planning). There may have been a certain disagreement between the conception of these authorities and the political necessities to which the Government was forced to submit during that phase. It is therefore easier for the Reporter to comment on this problem as it affected Italy, rather than as it happened elsewhere, but certain hints appearing in the replies received on this delicate matter make us think that a similar problem cropped up in one way or another for the other Railways concerned.

Where advantage was not taken of post

war reconstruction to get rid of non-paying lines, it would appear that public opinion did not fail to voice some remarks on the use of the financial means set apart for that purpose.

From this point of view, more favoured were the Railway Administrations who were able to lay down their plans by basing themselves on economic considerations only and deciding to abandon the lines which were previously showing a deficit. The countries, who could start the work of reconstruction under such favourable auspices, were able afterwards to carry out their programme of Railway rebuilding without having to make a continuous series of changes caused by non-economical considerations, which are no doubt going to have an important bearing on the future organisation of each Railway undertaking.

INTERNATIONAL RAILWAY CONGRESS ASSOCIATION

15th. SESSION (ROME, 1950).

QUESTION IX.

Modern safety and signal installations (centralising apparatus for block system and signals). — Central electric apparatus with individual levers and « all relay » levers (all electric interlocking). — Automatic block-system with continuous current and coded current. — Light and speed signalling.

REPORT

(Austria, Bulgaria, Czechoslovakia, Finland, Greece, Hungary, Italy, Portugal and Colonies, Rumania, Spain, Sweden, Turkey, Yugoslavia.)

by Rigo RIGHI,

Inspecteur en Chef supérieur au Service des Travaux et des Constructions de la Direction Générale des Chemins de fer de l'Etat italien; Rome.

A. LIGHT SIGNALLING.

- I. General considerations.
- II. Speed signalling and the means used to give effect to it.
- III. Replies received from the following Administrations:
 - a) Italian State Railways;
 - b) Austrian Federal Railways (OBB);
 - c) Czechoslovakian Railways;
 - d) Portuguese Railways;
 - e) Mozambique Railways;
 - f) Spanish National Railways (RENFE);
 - g) Swedish State Railways;
 - h) Hungarian State Railways.

I. General considerations

The replies received appear to indicate clearly that the present tendency is towards the use of speed signalling, route signalling

being either no longer employed or given a secondary or auxiliary role. This can be seen for instance in the case of signals controlling the approach to stations, when it desired to indicate to the driver the reason for the speed restriction already announced to him by the distant signal in rear.

Greater importance is given generally to signalling the route set up at junctions at the outlet to stations or between stations. There is some advantage in such a case in letting the driver know which line he is going to take. For this to be effected in time it ought really to be done at the distant signal.

Nevertheless it is considered that the indication of the route to be taken at junctions out on the open line is not by any means indispensable, and that the improvements continually being made in signalling installations make the possibility of

mistakes being made in setting up the route for a train more and more rare and improbable. This applies especially to lines worked by the « semi-automatic » block or lock-and-block, where the possibility of a wrong route being set up at a junction necessitates a twofold mistake on the signalman's part.

It can thus be concluded that even at junctions the signalling of the speed only can be restricted to the distant or approach signal and indication of the route set up can be limited to the home signal, with the secondary role it plays at the entrance to stations. It may be pointed out that, in the case of a junction for unequal speeds, where one line has to be taken at a reduced speed the driver does in fact know on passing the distant signal which line he is going to take.

Light signalling is being increasingly used instead of semaphore signalling. This is due to the better visibility of light signals and the fact that they take up less space on electrified lines, together with their ability to give a greater number of indications, as now called for and which it is unpracticable to give by means of semaphores. The choice between light signals having as many lenses and lamps as the colours required to be shown and those having a single lens (searchlight signals) with internal spectacle, is a rather complex question, depending on several variables of very varying importance on the different railway systems, according to the average conditions of visibility, the aims to be fulfilled by the various codes or aspects, and the necessity to have recourse to several lights showing at one time in order to give the indications required. As the advantages and disadvantages of the two systems are well known no useful purpose would seem to be served by entering into a discussion on them here.

The lamps used in signals having several lights showing at once or not are generally of greater power than those used in searchlight type signals. This comes from the fact and the very principle involved that in a searchlight signal a greater use can be

made of the light flux from the lamp by means of elliptical or spherical mirrors which cannot be employed in the other type of signal, where every source of internal reflection must be got rid of on account of the danger of « phantom » effects.

As regards the question of single or double filament lamps, the majority of managements appear to prefer the former.

It must be observed that :

— with two filaments, however close together, they may be, they are never both exactly in the focus of the lens or of the optical system of the signal, so that when one filament only is active there is a considerable diminution in the visibility of the signal;

— it is extremely probable that the same causes, mechanical or electrical, can injure both filaments, and hence when one fails the total failure of the lamp can very soon follow.

The proving of the signals is effected in the signal box and, in the case of the searchlight pattern, it must cover the position of the internal spectacle by means of change-over contacts on the relay and also the condition of the lamp, showing whether it is lighted or not. This latter condition is in practice very difficult to effect fully, because as is known, a very small reduction in the feed voltage will bring about a large reduction in the useful light flux and hence in the visibility of the signal. In a searchlight signal it is essential that, should a relay contact become fused to another, the return of the spectacle to the most restrictive position directly the relay ceases to be energised must not be hindered in any way.

Flashing has been introduced on some railways for signals at stations or junctions in order to give a less restrictive significance to a given combination of colours. In such a case it is essential that any failure of the relay which produces the flashing effect shall not extinguish the lights which depend upon it : after any failure they must remain steadily illuminated and this must give a

more restricted indication. On other Railways flashing has been used for subsidiary signals, or to control special types of traffic movements. Flashing can also be used to eliminate the «phantom» effect in the case of signals, which have several aspects, part lighted and part dark, as, for example, in Italy for calling-on signals (entrance under caution when the main signal cannot be cleared).

Comparative details concerning the degree of reduction in the amount of light periodically produced and the code used (relation between «on» and «off» timing) cannot be given from the information received.

Much study and care has been given by some Railways to the exact and objective definition of the colour characteristics of the glasses used in light signals (for example in Italy, where recourse has been had to very complete and strict methods, such as the system adopted by the International Commission on Lighting). It is considered that when such methods have been used and the colour characteristics of glasses defined, there is no need to bother about the possibility of confusing the red and the yellow. Nevertheless any arrangement of lights which by reason of their different positions with respect to each other and the number used in each particular combination, tends to prevent such confusion, is always useful. It may be remarked however that such arrangements do not in any way dispense with the necessity of defining exactly the colour characteristics of the glasses to be used and the close limits that they should conform to.

As regards the posts or other supports used to carry light signals on electrified lines, it is held that those independent of the traction contact wire standards are to be preferred for operating reasons. In particular the vibrations set up in the supports by the passing of the current collecting gear on the trains can affect adversely the life of the lamps when fine filaments are used, as is the case with lamps of low power working at voltages up to 20 or 30 or so.

II. Speed signalling and the means used to give effect to it.

As regards speed signalling, which, as we have seen above, tends now to be preferred and, it may be expected, will be increasingly so in future years (except at junctions at the outlet to stations or between stations), many both ingenious and interesting systems, have recently been proposed.

Examination of these systems would be beyond the scope of this report, which is intended to deal essentially with the replies received from the different managements, and to limit itself to the general considerations which the subject calls for.

I believe it is true to say that none of the managements which have replied to the questionnaire has as yet a complete speed signalling system in service, but rather a transitional arrangement to enable the change to such a system to be made in a more or less near future. The introduction at present of a complete system would possibly meet with two different obstacles which are both of considerable importance.

The first is very obviously of an economic order; the second, which is technical far from being independent of the first, is very closely allied to it.

It must not be forgotten that on the majority of railway systems semaphore signalling is still in use and will perhaps remain in use for many years, and when it is desired, as is very reasonable, that the night indications of the semaphores should not vary too much from those used in light signalling and that the costs of changing over should not be too high, we are inevitably led to adopt partial solutions of the problem or compromises which have to be judged not so much in themselves as from the possibility they afford of forming a transitional stage in the process of passing later on to a more complete solution and gradually to arrive, as in many other such technical matters, at a general solution of the whole problem.

Let us now consider these systems of


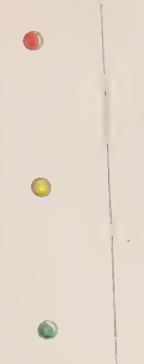


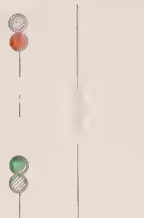
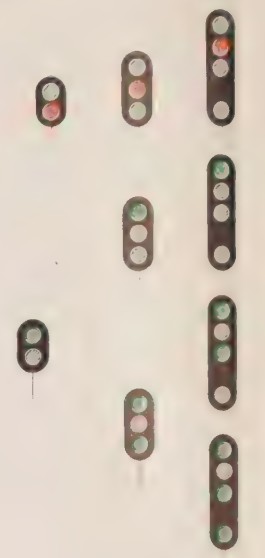
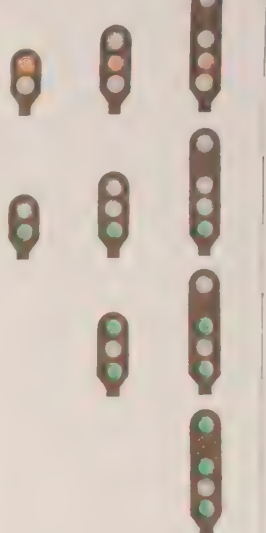

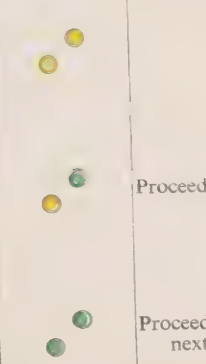
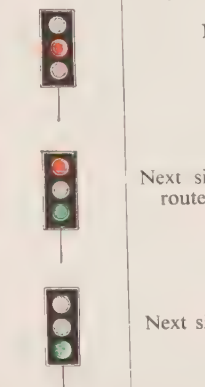
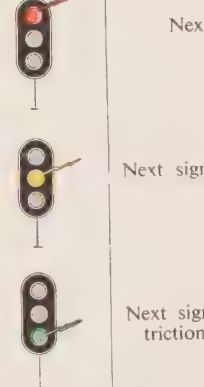
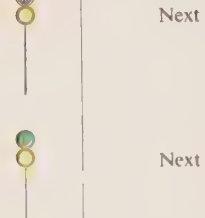



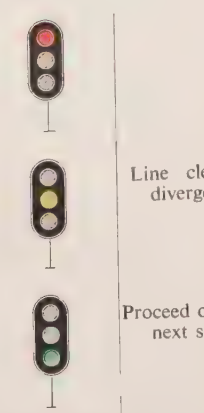
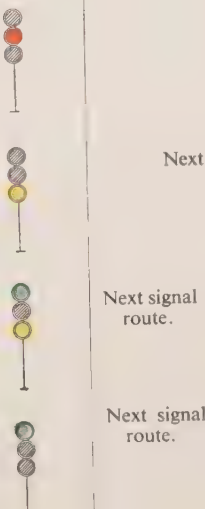
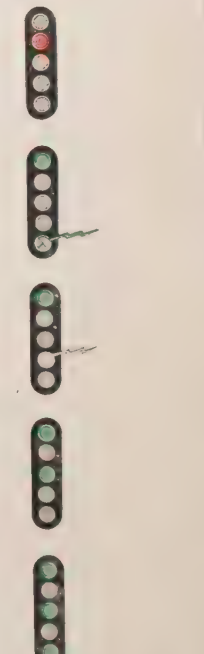

signalling. It may be said that with any system, and in particular a speed signalling one, the question must be looked at generally from two different angles. The first is what ought we to tell the driver, that is what we think really essential that he should know, from the point of view of running his train, in order to comply with the requirements of safety and at the same time to give the maximum flexibility of working and the best possible use of the capabilities of the locomotive and the characteristics of the line. The second concerns the means used to achieve this object, that is to say the way in which the signal aspects shall be arranged and the lights grouped to give the indications called for.

It can be asserted that, from the first point of view, a complete speed signalling system will have to indicate, for a train requiring to follow a route through a station, the condition of the block section ahead, and the speed that must be observed (or not exceeded) through the station limits, or from one end of the section to the other. The home signal must indicate to the driver, separately and with the maximum clearness, and simplicity, the speed that must not be exceeded, from the entrance to the station area to its outlet, that is at the signal itself and beyond, whereas at present in many cases, one is limited to giving, by the indication of one signal only, the speed that must not be exceeded on passing the following signal, at the end of the station or the block section. In other words, we often have speed signalling provided by the distant signal, but the speed imposed is not confirmed again at the entry to the station and brought again to the driver's notice there. When a station is in question, the indications showing the direction to be taken, which are auxiliary in character and which one may wish to give to the driver, should be independent of the speed indications, and not complicate in any way by their presence the indications of the main signals.

To enable these indications to have the maximum clearness, those referring to the speed at the entrance to and outlet from

stations may be given by lights at different levels on the signal, without attempting to mix them together, which would only result in introducing uncertainty in the signal aspects and make it difficult to interpret them.

Another question that may be asked is whether the signalling as given at present at the outlet to stations is complete enough in the case which is often met with where there are facing or trailing points in advance of the starting signal for a given line. Most often the starting signal is limited to giving (except in the case of an actual junction at such a location) two indications «stop» and «line clear». Is that sufficient? It can be held that a more complete solution would consist in arranging the starting signal in double form, one part acting as an actual starting signal, the second as a form of block indication, and in the case of automatically signalled lines forming the signal for entering the block section ahead. The first could be a speed indication showing the speed not to be exceeded over the outgoing route as far as the end of the station limits and announcing at the same time what the indication is that is being given by the other signal. It may be noted in this connection that even if through running is only allowed on the direct route, or main track, the problem may still exist in connection with the other tracks. Indeed much faster acceleration now being possible with electric motor coaches or internal combustion cars than with steam traction, the speed with which a train may reach the points at the outgoing limits of the station may become too high; the driver too should know at what point he is going to pass out of these limits and not have any other points to pass over or speed restrictions to observe, other than those which the route renders necessary. This differentiation is provided for very clearly in the Swedish system of signalling where it is obtained by the use of dwarf signals, and this signalling may be said to be very complete and rational. In particular it admits of indicating when the train is being sent along the wrong line (that is, contrary to the normal flow of the traffic) when it is not possible

ITALIAN STATE RAILWAYS.	AUSTRIAN FEDERAL RAILWAYS (O. B. B.).	CZECHOSLOVAKIAN RAILWAYS.	PORTUGUESE RAILWAYS.	SPANISH NATIONAL RAILWAYS (R. E. N. F. E.).	SWEDISH STATE RAILWAYS.	HUNGARIAN STATE RAILWAYS.
MAIN SIGNALS.						
 <p>Stop.</p> <p>Line clear.</p>	 <p>Stop.</p> <p>Proceed at speed reduced.</p> <p>Proceed without speed restriction.</p>	 <p>Stop.</p> <p>Line clear for divergent route.</p> <p>Line clear for main route.</p>	 <p>Stop.</p> <p>Line clear.</p>	 <p>Stop.</p> <p>Line clear.</p>	 <p>Stop.</p> <p>For a main route.</p> <p>Diverging route of greater length.</p> <p>Diverging route with shorter line (in the case of a crossing)</p>	 <p>Stop.</p> <p>Line clear for main route.</p> <p>Line clear for divergent route, 2nd track, 4th track Turnout.</p> <p>Line clear for divergent route, 3rd track, 5th track Turnout.</p>
DISTANT, CAUTION OR OUTER SIGNALS.						
 <p>Next signal is at stop.</p> <p>Next signal : line clear, route to run at speed not exceeding 30 km/h (18 m.p.h.).</p> <p>Next signal : line clear, route to run at speed not exceeding 60 km/h (37 m.p.h.).</p> <p>Next signal : line clear, no speed restriction.</p>	 <p>Next signal is at stop.</p> <p>Proceed at reduced speed from next signal.</p> <p>Proceed without speed restriction from next signal.</p>	 <p>Next signal is at stop.</p> <p>Next signal : line clear for divergent route (left or right).</p> <p>Next signal : line clear for main route.</p>	 <p>Next signal is at stop.</p> <p>Next signal : pass at reduced speed.</p> <p>Next signal : pass without speed restriction.</p>	 <p>Next signal is at stop.</p> <p>Next signal : line clear.</p>	 <p>Next signal is at stop.</p> <p>Line clear on diverging route at next signal and means "proceed with caution".</p> <p>Line clear at next signal.</p>	 <p>Next signal is at stop.</p> <p>Line clear at next signal for divergent route.</p> <p>Line clear at next route for main route.</p>
COMBINED, STOP AND DISTANT SIGNALS.						
 <p>Stop.</p> <p>Line clear. Next signal is at stop.</p> <p>Line clear. Next signal : line clear, route to run at speed not exceeding 30 km/h (18 m.p.h.).</p> <p>Line clear. Next signal : line clear, route to run at speed not exceeding 60 km/h (37 m.p.h.).</p> <p>Line clear. Next signal : no speed restriction.</p>			 <p>Stop.</p> <p>Line clear — speed restriction for divergent route or next signal at stop.</p> <p>Proceed on main route with line clear at next signal.</p>	 <p>Stop.</p> <p>Next signal is at stop.</p> <p>Next signal : line clear, pass on divergent route.</p> <p>Next signal : line clear, pass on main route.</p>	 <p>Stop signal (and next exit) at stop. Warning sig. gives flashing green light.</p> <p>Line clear for main route. Next signal is at stop. Warning signal gives flashing white light.</p> <p>Line clear on main route. Line clear at next (exit) signal. Warning signal gives flashing white light.</p> <p>Line clear for divergent route of greater length. Warning signal gives one flashing green and one fixed yellow light.</p> <p>Line clear for divergent route of shorter length (case of crossing). Warning signal gives one flashing green and one fixed yellow light.</p>	
			MOZAMBIQUE RAILWAYS.			
			 <p>Stop.</p> <p>Next signal is at stop.</p> <p>Line clear without speed restriction.</p>			

to send it along the ordinary line because the track or the overhead traction wire is under repair.

We have now to analyse the second point of view involved in the problem, that is how to give effect to the indication we desire to convey to the driver.

It is unnecessary to say anything with regard to the absolute stop indication, but when it comes to the less restrictive indications, one important point arises. What is the best way of using green lights? In many signalling systems the degree of restriction conveyed increases with the number of green lights, or at least a green light combined with a light of another colour (most frequently yellow) gives a more restricted indication than a green light shown by itself. The objection of this, as is well known, is that should the other green lights or the different coloured light fail, as result of a blown fuse or any accidental interruption occurring in the circuit, a false and less restrictive indication is given to the driver. It is true that such a failure would cause a failure in the repeating or proving circuit and arrangements can be made so that the resulting de-energisation of the proving relay changes the aspect of the signal to one that is more restrictive than the one that it was desired to give, or could be given, but there is no doubt that this complicates the installation.

The arrangement under which the restrictiveness of a signal increases with the number of lights shown over and above the one, as it may be termed, fundamental green light, has nevertheless an advantage from the point of view of any accidental contacts between wires which may occur seeing that in that case the illumination of a greater number of lamps than that intended makes the signal a more restrictive one.

An opposite solution in which the restrictiveness becomes less with an increase in the number of lights shown over and above the one would naturally have both its advantages and disadvantages such as might be produced under the supposed failures of opposite kind to those just considered.

If any opinion can be expressed on this point, it would be that the optimum solution would be for the indications to be given at all times by the same number of lights so that when a failure to light up occurs, a meaningless indication is produced, which informs the driver that a failure has occurred and requires him to proceed cautiously.

It may also be remarked that when one considers the possibility of a simple contact or several contacts between different conductors, since these are always active, that is they are traversed by the current feeding the lamps, the failure is never dangerous and when it is a question of conductors of different polarity, brings the fuses or protecting circuit breakers into action.

This solution of course is possible only with signals in which the colour is changed inside the unit, that is with the searchlight type. This is of practical interest if that less space is occupied by the signal.

III. Replies from various Administrations.

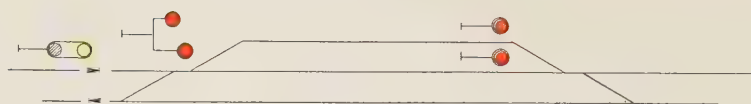
a) Italian State Railways.

1. — The signalling of the speed at the distant, or caution, signals, is completed by the indications showing the direction to be taken by the train given at the stop signals ahead, arranged in bracket form. These indications give the driver what amounts to an explanation of the speed indication he has received at the signal in rear and serve to confirm it. The same applies to junctions on the open line.

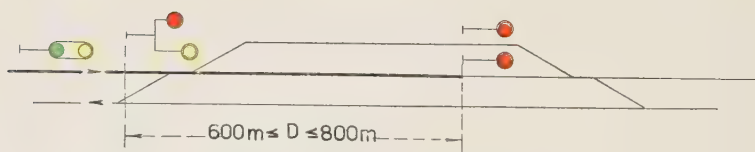
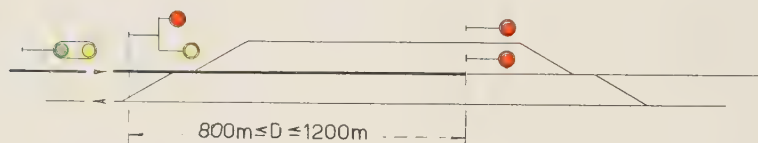
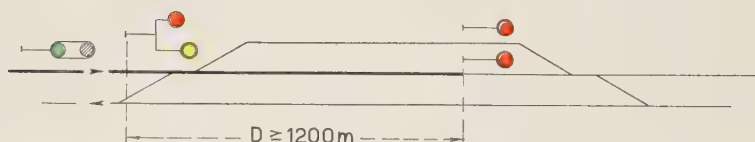
2. — See diagram.

3. — As stated above, the signalling used at junctions gives a direction indication at the stop signals. This is thought to be sufficient. It is found in fact that at non-symmetrical junctions, where one route must be taken at reduced speed, the indication of the speed given by the distant signal is sufficient to enable the driver to know over what route he will run. The situation is less favourable at symmetrical junctions, but with the lock-and-block working in the form used in Italy the setting up of a wrong

Examples of Italian signalling.



SIGNAUX À L'ARRÊT



Signaux à l'arrêt = Signals at stop.

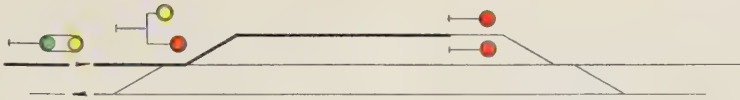
Clear to enter station on direct route; starting signal at stop.

route means that the junction signal man must have made two mistakes, one when he asked « is line clear » on one branch instead of the other, and the second when he cleared his signals for the train. The number of such junctions, be it noted, is very small on the Italian lines.

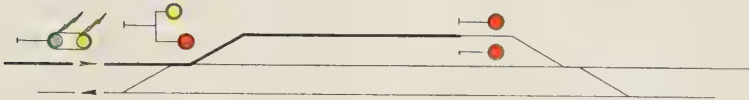
4. — Generally the internal spectacle, with two or three spectacle glasses, or « searchlight » type of signal is used which, obviates the difficulties arising from the « phantom » effect produced by the sun's rays, particularly at sunrise and sunset, in the case of signals facing east or west.

In tunnels difficulties of this kind are of no moment and signals having as many units as lights to be shown are also used in them, which is an advantage both from the economic point of view and that of the reduced space required.

5. — Part of the outer optical assembly known as a diffuser or spreader (the purpose of which is to give to the light rays leaving the signal a sufficiently wide angle to suit the curves at the approach to the signal), is provided with horizontal steppings which direct a portion of the beam downwards and give a « close-up » indication.



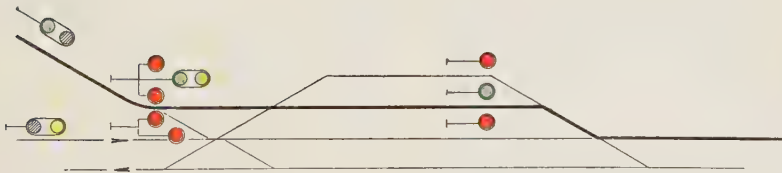
Clear to enter station at not more than 30 km (18 m.p.h.)/h on diverging route; starting signal at stop.



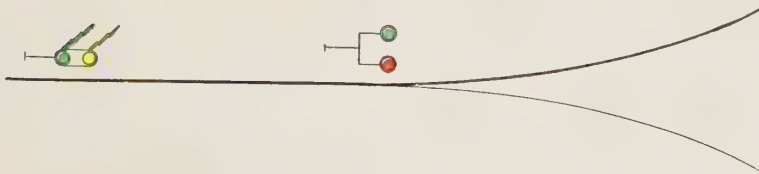
Clear to enter station at not more than 60 km (36 p.m.h.)/h on diverging route; starting signal at stop.



Clear to run through on main route.



Clear to run through with diverging route at exit signal.



Equal-speed junction.

6. — Single filament lamps are used. The voltage is 12 or 16, or also 95 and, for those signals fed with d. c. : 144 volts. The difference between 144 and 95 volts is due to the drop in voltage on the line and in the regulating resistances. The wattage is 20. The optical system is formed of a spherical mirror and an aspherical lens giving a light beam of practically parallel rays. The spreader above mentioned imparts to the beam an horizontal angle of spread.

There are three types of spreader in service :

- Type O, giving a beam with 8° spread;
- Type A, giving a beam with 14° spread
- Type Bs or Bd, giving an unequal spread of up to 20° to the left (Bs) or to the right (Bd).

The downward spread for the close-up indication amounts to 40° .

The diameter of the aspherical lens is 142 mm (5.590" appr.). The spreaders are set at an angle of 25° in front so that the sun's rays which fall on the outer surface, or nearly horizontally at sunrise and sunset, cannot be reflected towards the driver's eye. In this connection the application of an anti-reflecting treatment to the surfaces of the optical assemblies is being looked into (low reflecting films).

7. — The signals are operated from the signal box by means of a conductor (most often a cable) which runs to the relay which moves the internal spectacle, others being provided to feed the lamp through a transformer. There are always separate conductors for repeating the signal in the signal box. As stated, signals are used with feed and proving circuits supplied exclusively at 144 volts, a very good and economic solution for small signal boxes where the costs of installing a power set to ensure continuity of a. c. supply would be relatively very heavy.

8. — The proving of searchlight type light signals includes the position of the spectacle mechanism and the regular lighting of the lamp. The condition of the stop

signal is proved in connection with the giving of the indication at the distant signal in rear. This is done through proving relays.

9. — The yellow and green indication at the distant signals is made flashing when the speed limit at the signal in advance is 60 km (37 m. p. h.) instead of 30 km (18 m. p. h.). The periodicity of flashing is 60 per minute, the lamps being fully lighted for $2/3$ rd and partially lighted for $1/3$ rd of the time. (The feed to the lamps is never completely interrupted.)

If the variation between the two degrees of illumination is made sufficiently large, the appearance of flashing is quite clearly noticeable.

10. — The coloured glasses are very carefully tested spectroscopically.

There are very narrow limits laid down to govern the chromatic properties of the glasses, expressed by the tri-chromatic colorimetric methods of the International Commission on Lighting Standards.

11. — On the electrified lines light signals are used exclusively.

12. — Independent supports are used for the signals, as a rule, as this makes the replacement of lamps much easier.

13. — There is no special signalling for wrong line movements.

Austrian Federal Railways (O. B. B.).

1. — The signal indications are essentially speed indications, but in a few special cases indications showing the route set up are provided by means of alphabetical signs.

2. — See diagram.

3. — In this case route indications are given, as mentioned under 1 above.

4. — Multiple light signals are used.

5. — No reply to this question.

6. — The lamps are 50 watt, 15 volts. The external diameter of the lens is 150 mm (5.905" appr.). The horizontal spread is 16° and the vertical spread reaches 30° .

7. — The signals are fed by alternating current through transformers with a ratio of 220/12 and the lights are repeated in the signal box.

8. — No reply to this question.

9. — Flashing lights are not used.

10. — The red has a tendency towards blue.

11. — Light signals are used normally on electrified sections.

12. — The signals are carried on their own posts or supports.

13. — There is no special signalling for wrong line movements.

Czechoslovakian Railways.

1. — In the new signalling code all route indication has been eliminated and speed indications only provided, using 3-aspect signals.

2. — See diagram.

3. — It is not thought necessary to give route indications at junctions out on the open line.

4. Signals having several light units are used in which the various colours are produced not by using coloured lenses but by coloured glass screens inserted between lamp and lens, the latter being strongly curved. No practical defects are found with this arrangement.

5. — Even with a strongly curved lens visibility at the foot of the signal is sufficiently good.

6. — Both 35 and 50 watt lamps are used, single filament, fed at 12 volts. The lens diameter is 138 mm (5.433" appr.). The horizontal spread is 4°, 8°, or 16°, the vertical spread being generally equal to the horizontal except in the case of the 16° lenses, where it is somewhat less.

7. — The lamps are fed directly from the signal box without using relays.

8. — There is no lamp proving between the signal in advance and the signal in rear.

9. — Flashing lights are not used.

10. — No special precautions are taken in this matter.

11. — It is intended to make systematic use of lights signals on electrified lines.

12. — Independent supports are used as a rule.

13. —

Portuguese Railway Company.

1. — As a rule in the new signalling speed indications only are given, route indications being given a secondary and advisory role, at the entrance to stations where a train is received over a deviating route. At junctions out on the open line, however, route indications are given.

2. — See diagram.

3. — The route indication at junctions serves to advise the driver to what line he is being directed.

4. — Up to now signals having several lamp units have been used, each provided with a coloured lens, but to effect a comparative test it has been decided to instal some «searchlight» signals.

5. — Attachments are fitted to the outer lenses. The latter provide the horizontal and the former the vertical spread, downwards, to give an indication at the foot of the signal.

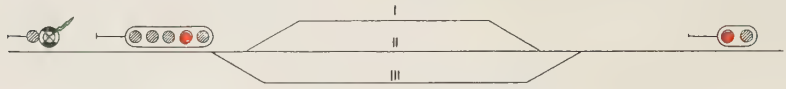
6. — Experience has not provided any reasons for preferring single or double filament lamps. The wattage of the single filament lamps (with double spiral in the filament) is 35 at 70 volts; the wattage of the double filament lamps is 15/15, and the voltage 30. The external diameter of the lens is 140 mm (5.511") or 70 mm (2.755") in shunt signals. The VES and Ericsson types are used.

7. — The lights are controlled from and repeated in the box.

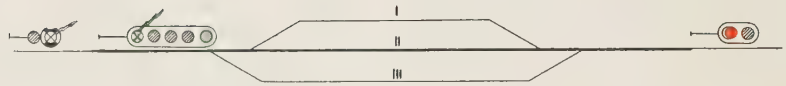
8. —

9. — In the new signalling flashing is being applied in the distant or caution signals.

Some examples of signalling on the Swedish Railways.



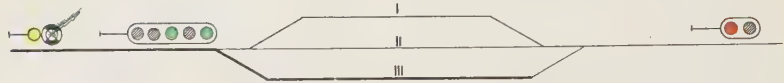
Signals at stop.



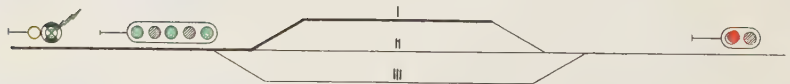
Entry onto main route with starting signal at stop.



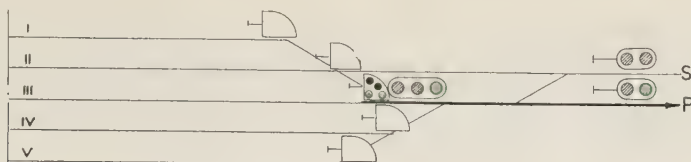
Proceed on main route.



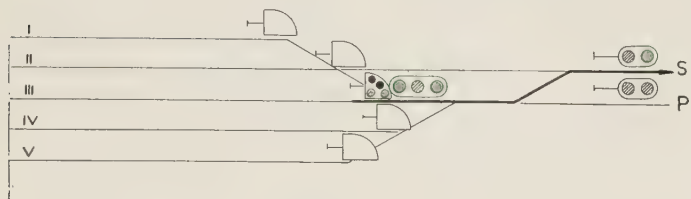
Entry onto divergent route (long turnout).



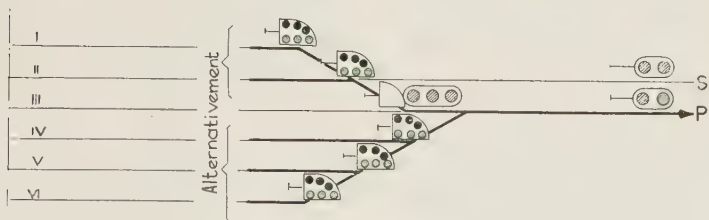
Entry onto divergent route (short turnout).



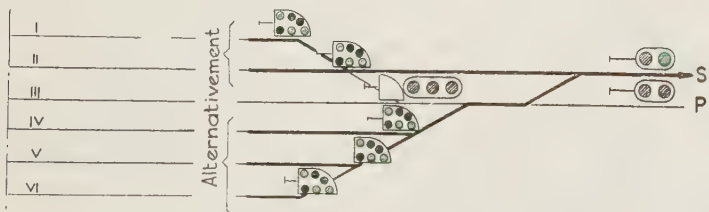
Departure from track III with line cleared via track P.



Departure from track III with line cleared via track S.



Exit signals (near the ground) for departures from tracks I, II, IV, V or VI alternately, via track P.



Exit signals (near the ground) for departures from tracks I, II, IV, V or VI alternately, via track S.

10. — A light yellow, as distinct as possible from red, is used.

11. — For new electrifications, the systematic use of light signals is contemplated.

12. 13. — No decision has been come to on these questions.

Mozambique Railways.

1. — Auxiliary route indications are given by means of numerical signs lighted up from the signal box and indicating the number of the track to which the train is being sent.

2. — See diagram.

3. — No speed indications are given at junctions.

4. — The VES type searchlight signals are used.

5. — The close-up indication is given by position lights at the foot of the signal.

6. — Single filament 6.5 watt 8 volt lamps are used. The position lights are 4 watt. Lens diameter is 140 mm (5.511").

7. — The proving is effected through relays.

8. — No.

9. — Flashing lights are not used.

10. — No difficulty is found in distinguishing red from yellow.

Under unfavourable conditions longer hoods are sufficient to protect against external light rays which fall on the external lens practically horizontally at sunrise and sunset.

11. 12. — No reply has been received to these questions.

Spanish National Railways (RENFE).

1. — Speed indications only are given. Route indications are limited to the one case of a junction out on the open line where the two routes can be taken at the same

speed. The route indications in that case are given by a distant signal in bracket form so that the driver shall know on passing it what route has been set up for him, and should a mistake have been made, be able to stop in time.

2. — See diagram.

3. — The route indication appeared essential for the reasons given above.

4. — Searchlight signals are considered to have an advantage in being free from «phantom» effects, and in using less powerful lamps; the latter is especially appreciated when primary battery feed is used. Nevertheless the simpler construction of the multiple lens type of signal has its attractions and no serious practical objection to their use has been found.

5. — Part of the lens has horizontal steps in it, which give a downward spread to the beam.

6. — Single filament lamps are used. The wattage of the lamps in multiple lens signals is 18, at 10 volts, and in the searchlight signals 5 watt, 10 volt lamps are used. Double Fresnel lenses 210 mm (8.267") diameter, are used, with 3° horizontal and 3/4° vertical spread.

7. — In the case of multiple lens signals a feed through a relay at the base of the signal is used. The «line clear» indication is proved as a rule.

8. — There is no lamp proving between the signal in advance and the signal in rear.

9. — Flashing lights are not used.

10. — The colour characteristics of the various lens are carefully checked.

11. — Light signals are used systematically on electrified lines.

12. — Hitherto independent supports for the signals have been used, but no objection is felt to fixing the signals to the traction standards in the case of new electrifications.

13. — There is no special signalling for wrong line movements.

Swedish State Railways.

1. — In the signalling used at the entrance to stations route indications, formed of one, two or three green lights, are provided. This enables the driver to know what route has been set up for him.

2. — See diagram.

3. — Complete route signalling enables the driver to be sure that a particular route, decided on beforehand, and laid down in his service book, has been set up correctly for him. In this way he checks the action taken by the signalman or person in the station responsible for dealing with his train, but with speed signalling he cannot do that. A purely speed signalling system thus necessitates more complete safety precautions, and especially the use of track circuits, in order to give an assurance that the working is really safe.

4. — Colour light signals are used, having several units, with double lenses, 8 3/8 ins. in diameter, and also the 2- aspect and 3-aspect searchlight type. For constructional reasons the multiple unit type of signal is used at stations where route indications are necessary. Searchlight type signals are used on lines equipped with automatic signalling and for distant signals and have the advantage of eliminating «phantom» indications.

5. — The multiple unit type signals use «Foric» type elements on the outer lenses. In the searchlight type, there is a refractory element giving a side spread in the centre of the lens.

6. — Single elements 24 watt, 12 volt lamps are used in light signals, with 8 3/8 ins. diameter lenses in all types. On straight track the horizontal and vertical spread is about 30°. In certain cases lenses with an 8° horizontal and 4° vertical spread are used. In extreme cases a horizontal spread of 30° and vertical spread of 3 1/2° are used. The central «close up» element gives a 30° spread, sloping towards the track.

7. — A signal is controlled directly from the signal box or through a relay

placed near to it, according to its distance from the signal box. The working of all the lamps is always proved in the box and on the track diagram the indications «stop» and «line clear» are repeated, i. e. a signal at «line clear» is repeated in one and the same manner, irrespective of whether it shows, 1, 2 or 3 green lights.

8. — Such proving is always provided through a relay in series with the signal lamp.

9. — A flashing light is used in the distant or caution signals, both in automatic signalling and at stations. The periodicity is 60 per minute, both for electrically and gas lighted signals.

10. — A yellow light is used only in special cases where it cannot be confused with red, and therefore no precautions against mistakes have been taken.

11. — Light signalling will be gradually introduced everywhere, whether a line is electrified or not.

12. — On electrified lines the signals are attached to the traction wire supports where possible; this arrangement has given satisfactory results.

13. — In the case of wrong line movements, on lines fitted with automatic signalling dwarf type signals but larger than those used in the stations, are now being employed. This has been done to enable the driver to distinguish clearly between the signals for the normal or left-hand track, and those applying to wrong line movements. The ability to deal with traction contact wire maintenance is only a subsidiary reason for adopting this arrangement. Facility of track maintenance is another, but it has shown itself to be advantageous from several other points of view.

Hungarian State Railways.

1. — Route indications are used only at junctions at the outlet from stations, or on the open line. This enables the driver to check whether the route set up for him is correct or not.

2. —
3. — The reply to this is given under 1 above.
4. — Signals having several lens units and showing red, yellow, and green, of the VES type, are used.
5. — No special arrangements are used to improve the indications when viewed from the foot of the signal.
6. — Single filament lamps, 50 watts, 50 volts, are used, but in signals some distance from the box 100 watt, 100 volt lamps are fitted. The optical equipment is of VES pattern.
7. — The lamps are fed directly from the signal box and repeated in it.
8. — No proving of this type is used.
9. — Flashing lights are not used.
10. — The yellow light is never used singly.
11. — On the electrified lines light signals are being systematically used.
12. — Independent supports for the signals are always provided.
13. —

B. ELECTRIC POWER SIGNALLING INSTALLATIONS USING INTER-LOCKED LEVERS OR FREE PUSH-BUTTONS.

- I. General considerations.
- II. Note on the system proposed by Dr. G. ARIAS.
- III. Replies received from the following Administrations:
 - a) Italian State Railways;
 - b) Czechoslovakian Railways;
 - c) Portuguese Railways;
 - d) Mozambique Railways;
 - e) Spanish National Railways;
 - f) Swedish State Railways;
 - g) Hungarian State Railways.

1. — The tendency is at present to use ever increasingly the free push-button kind of apparatus with route-setting control, both

for large and small installations, and for several reasons of an operating and economic character.

With the free push-button type signal boxes it is indeed possible to carry out a great number of movements in a short time, as is required during certain hours of the day when trains arrive at and depart from a station in rapid succession.

The free push-button signal boxes, in the small compact desk form, allow of being worked with a reduced number of signalmen, which is an obvious economic and operating advantage. At times it is possible to have on single push-button signal box in place of several having individual levers and then the advantages are greater still.

In the case of the small installations the advantage of taking up less space is even more important, since it becomes easy to place the desk «panel» in the station-master's office without being obliged (as often happens) to undertake a good deal of expensive work. It is true that the free push-button boxes require a greater number of relays than those having individual levers, but it is to be noted that it is possible to place relay cupboards, even large ones, in some secondary portion of the building and this involves much less expense than would have arisen with an individual lever installation.

The choice between using buttons or small levers on the track diagram of the station, which also carries the repeater indications for the signals, points and track circuit sections, or on an independent desk panel or «console», depends on several considerations, in which the number of buttons required plays an important part. In the small installations the problem of space arising when the buttons are on the diagram itself is easily solved. No doubt this arrangement appears to be preferable because the operating processes suggest themselves intuitively to the signalman. He has only in fact to follow the route he wishes to set up and actuate the buttons or small levers from one end of it to another, as he meets them, as happens when the complete route is divided into two or three partial routes. It is even easier in those installations

in which the signalman has only to actuate the buttons or levers at the ends of the routes, as he has only to concern himself with the two points of departure and arrival on the panel for the route in question to be set up. In considering too the reduced dimensions of the panel in the small installations and the limited number of routes, the so-called « geographical » arrangement would appear to be the preferable one.

However, the solution is very different when very important stations are concerned, where several lines converge on it in a somewhat complicated layout, with a considerable number of routes, both for train and shunting movements. And if the fact is taken into account that merely for reasons of clearness, the dimensions of the geographical diagram or panel cannot be reduced below a certain minimum then it is seen that the geographical arrangement has in practice to be rejected, and for that reason the arrangement with the handles arranged on a separate panel or console is to be preferred. It is true also that in the large signal boxes the signalmen must be perfectly acquainted with the layout of the station and the different routes in it, and for such well trained and permanent staff the advantage of an immediate view of the buttons or handles to be actuated loses much of its importance. It is for this reason that the *Italian State Railways* have preferred in the case of the large installation at Bologna to use miniature levers on a separate panel.

However, the problem of how to deal with large installations would gain from further discussion and it is possible to arrive at a different conclusion if there is a change in the fundamental details. In fact if the number of buttons can be appreciably reduced (for example by using multi-position handles, with different positions for the different conflicting routes leading to a common point), then the geographical arrangement with all the associated advantages can once more be considered.

The NX and UR American systems, and similar systems, not only cause a route to be set up by actuating buttons placed at

the ends of that particular route, but also allow of selecting a free route from among the different ones which are possible between the two points in question, and this too in some predetermined order.

There is no doubt that this is a very clever solution of the problem, but it is doubtful whether it is really of advantage in practice. It should be noted in fact that it is desirable for a signalman always to know what route he is going to make use of between the two points concerned, since there will be many cases in which the free route then chosen, in view of other shunting movements or train routes which the signalman desires to make shortly, might differ from the route given at that particular moment by the selection already made in advance. Since this automatic selection gives rise to much complication in the installation it would appear that its application cannot always be looked on as advantageous from the practical point of view.

The general attitude is that in considering these installations one ought never to lose sight of the relative advantages, if any, which the introduction of certain automatic features allows and the complications thereby involved. It must not be forgotten that every additional complication increases the risk of failure, and makes it more difficult to locate the fault, as well as making the general maintenance of the installation less easy. It is true that at present there is not too much difficulty in finding maintenance staff to deal with free push-button installations, for there are many other kinds of installations in use on a modern and important railway system which are just as complicated and call for a fairly high standard of technical ability in the staff. But since in the case of the free push-button signal boxes it is a question of installations in isolated places, too much skill cannot be expected of the maintenance staff and therefore the speedy illumination of faults must be made particularly easy.

To enable the staff to find out the position immediately a fault does occur, starting from an examination of the indications on the luminous track diagram which shows which

parts of the installation have not functioned as intended, it is of special advantage to have the circuits as simple as possible, and also to have the arrangement of them as simple and logical as possible in relation to the geographical layout of the components of the installation to which they refer.

This refers particularly to the electric route locking circuits. From this point of view, circuits as short and as divided up as possible are without doubt to be preferred and that, in our opinion, is an important reason for giving preference to one system rather than to another.

A system in which all the handles are free at all times and which takes particular account of these conditions, from the point of view of simplifying the installation, is that designed by Dr. ARIAS, Chief of the Head Office of the Signal Department of the Italian State Railways.

The description of this system appeared in a note published in the Italian journal *Ingegneria Ferroviaria* for December 1949. A brief resume of this and a short description of the system, which is simple and interesting, are given in the accompanying note.

II. Note on the system proposed by Dr. G. ARIAS.

The characteristics of this equipment are more particularly the following :

1. *Dividing up of the routes for the sole purpose of simplifying the installation.*

The special method of dividing up the routes described in 2), allows of that being done without any multiplying of the controlling items in the apparatus. It follows that this equipment offers all the advantages associated with the dividing up of the routes, which will now be explained.

Routes for shunting movements are, as a rule, divided up at certain points, suitably chosen, in such a way that the routes, from one signal to another, or to some arrival point, are in great measure composed of several partial routes.

For each such partial route there is a so-called electro-combiner, or a set of relays.

The dividing up of the routes presents these advantages :

- reduction in the total number of electro-combiners, or sets of relays;

- smaller number of contacts on each electro-combiner, as the number of points which it has to operate is reduced;

- the possibility of a movement traversing any of the available paths, as the signalman chooses, between the starting and finishing points of a route, without having to increase the number of electro-combiners or contactor relays or complicate the installation.

Routes for running movements can be divided up in the same manner as those for shunting movements.

It follows that the releasing of the routes is likewise divided up and in consequence affords a sufficient freedom of movement.

To economise in the number of contacts the electro-combiners applying to running movements, instead of operating the points direct, actuate the electro-combiners of the shunting routes and the relative shunt signals when the latter have themselves to be cleared for a running movement.

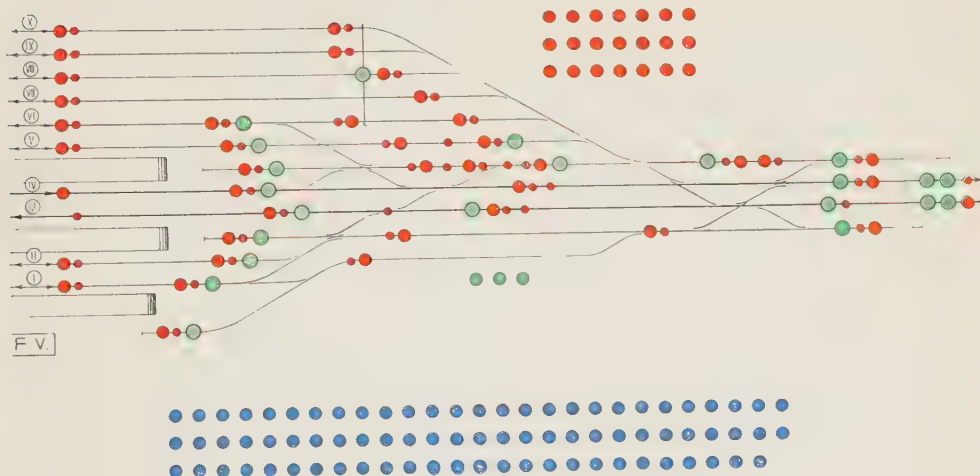
In the printed account of this system the electrical interlocking to be effected between the electro-combiners is described. Complete interlocking between those relating to running and those relating to shunting movements can be eliminated by using proving relays which ensure that the signals situated along a running route will only clear for a train when that route is completely set up ready for it.

2. *Multi-position handles, selecting not only the route, but also the direction of running applicable thereto.*

As in the case of systems using « entrance » and « exit » buttons, the system

APPENDIX A.

- Small levers and push-buttons set out for apparatus with combined block relay (No. 80).
- Separate handles and push-buttons for apparatus with combined relays or with combinations of relays and multiple position handles differentiating between route and direction. (No. 25).
- Push-buttons for apparatus N. X. (No. 108).



in question comprises a geographical panel, or track diagram desk, from which the installation is controlled and on which the signals, points and track sections are repeated.

This panel differs from the «entrance» and «exit» type chiefly by the parts used to operate the lineside equipment and the different signalling methods used.

Instead of buttons or knobs there are small handles selecting the route and the direction of travel over it. These handles carry an indicating arrow and can be rotated to take up several defined positions — for example six. There is in addition a small 3-position lever (normal, reversed to the right, reversed to the left) co-axial with the handle and returned to the central position by spring power. The various positions of the handle show what route it is intended to set up, and the reversed

positions of the little lever show the direction of travel.

These handles are represented on the diagram in appendix No. 6 to the type-written note. Their contacts actuate the relays that control the routes, complete or divided.

The use of these handles allows of effecting a manual selection of the routes and in consequence avoiding the use of the automatic selection seen in the «entrance» and «exit» type of push-button apparatus.

Appendix A shows that by using these handles the number of controlling elements on the panel is reduced to less than a quarter of those used in the «entrance» and «exit» apparatus, and to less than one third of the 3-position levers used in the electro-combiner types of installations having levers in rows.

It follows that these panels are simpler in construction than those of the «entrance» and «exit» types.

3. *Use of sets of ordinary relays in place of electro-combiners or apparatus possessing mechanical features.*

The replacement of electro-combiners by sets of relays as described in 3 of the printed account is another characteristic of this installation. The relay assembly to be preferred on account of its simplicity is that formed of a relay with holding feature of gravity type, and certain neutral relays.

As regards the actual working of this apparatus and the method of carrying in into effect, the article and the note attached may be referred to.

Summing up, the system presents the following advantages :

Operation:

A simple operating panel, on which everything necessary is grouped in a very clear manner, enabling the signalling to be effected, without the signalman being overloaded with too many visual indications.

To deal with the running movements, the signalman as a rule only needs to actuate two elements, one at the entrance to and the other at the exit from the route, as in the «entrance-exit» systems, but with the advantage that he is free to choose from among the various paths available that which it is preferable for use between the two points, taking into account not only the movements actually in progress but also those which he intends shall follow them.

In some cases, and always in the case of shunting movements, the signalman actuates a single element on the panel, but visual indications appear similar to those seen when he actuates two.

For running movements he operates generally one or two items, according to whether the routes are divided up or not.

As has been mentioned, the releasing of the route locking is automatic, but it can be arranged to be done manually at the signalman's choice.

It is unnecessary to point out the practical character of this equipment from the operating point of view, when compared with those in which the track diagram and controlling panel are separate from one another.

Technical and economic considerations.

The type using relay assemblies appears to be preferable to that using electro-combiners, if only because relays have a higher regularity of operation than an apparatus of a mechanical nature.

In the relay type, mentioned as the best, ordinary neutral relays are used, having a limited number of contacts and self-holding relays of simple design, with gravity action, already known.

This system by its particular form of construction is easily able to meet the most varied conditions of traffic working, contrary to those using «entrance» and «exit» buttons, in which it is not so easy to realise conditions varying from the normal, such as the locking of points not traversed by trains or shunting movements.

In addition, the dividing up of the circuits makes it possible, as has been done in a few installations, to keep apart the sources of supply and this offers several advantages where a breakdown, due to electrical causes, occurs in the installation.

III. — Answers from the various Administrations.

a) Italian State Railways.

1. — For large and important stations the free push-button system with route-setting control, is now preferred as it allows of setting up in a short space of time a larger number of routes and to reduce the number of signalmen in each signal box.

2. — In the case of individual lever apparatus electric interlocking is usually employed.

3. For a signal reading over several routes there are as many levers as there are routes.

4. — In the signal boxes now in course of construction or being planned it has been decided to place the free push-buttons or miniature levers on a separate panel, because it was not practicable to fit them to the track diagram carrying the signal, point and track indications. However the introduction of systems such as the NX or UR is now being investigated and in this case the push-buttons will be on the diagram.

This possibility is afforded also by any system which reduces the number of buttons, seeing that it is entirely a matter of space.

5. — In the installations now being built automatic selection of routes is not provided for, and it is doubtful, in our opinion, whether it brings any real practical advantage.

6. The principal advantage of the free push-button equipments is that of giving a greater flexibility of working, as mentioned in 1 above.

7. — There is no doubt that the free push-button type of signal box is more complicated as regards the circuits than those having interlocked levers, and calls for a higher level of technical knowledge among those who have to maintain it. It is to be noted, however, that the technical training required at present in order to maintain the electric power signal boxes, automatic signalling apparatus using coded currents and other systems in current use under present technical developments, is already of a sufficiently high level to make it easy to select staff to maintain the free push-button type of signal box. It is, of course, necessary to allow a suitable amount of time to elapse before putting an installation in service to enable the staff to become familiar with the circuits and learn to read and interpret the diagrams when requiring to find a fault.

It is also desirable that the circuits used in these signal boxes should be as simple as possible, all automatic working and other complications being dispensed with, if need be.

8. — We have no experience as yet of such installations but the general considerations given in 7 above apply.

9. — We are of the opinion that the first costs are less for the free push-button type, since experience has shown that it is the mechanical parts that are more likely to become faulty in the course of working. The advantage of the free push-button arrangement will be all the greater the simpler its design, and it is considered that it is that end that efforts and future improvements should be directed.

10. — We have no experience on this point. It is considered too that the indications on the illuminated diagram are sufficient to enable faults to be looked for. Such arrangements as the plug-in type of relay which the Italian State Railways introduced many years ago are very useful, enabling a defective item to be removed without having to disconnect and refasten any wiring.

11. — We have no installations of this kind in service.

12. — The electrical constant detection of points is included in the controlling circuit of the stop signals worked from the box and is essential to maintaining the « clear » indication (positive detection).

b) Czechoslovakian Railways.

1. — For large stations, hitherto the individual lever system has been used. We have no experience of the free push-button apparatus but consider its use would be advantageous in view of the flexibility of working and the greater number of movements that can be dealt with.

2. — Mechanical interlocking is always used with individual levers.

3. — We have no selection.

4 - 5. — We have no experience on these points.

6. — It is considered that the advantages of the free push-buttons are notably the smaller size of the panel and the greater flexibility obtained.

7 - 8 - 9 - 10. — We have no information enabling us to reply on these points.

11. — In the electro-pneumatic installations it is not easy to ensure the air-tightness of the compressed air piping and eliminate water being formed by condensation; beyond that the maintenance is not troublesome.

12. — Constant detection is included in the circuits of the relative protecting signals.

c) Portuguese Railways.

1. — Hitherto we have used levers interlocked mechanically.

2. — The advantages of the free push-button arrangement lie particularly in the reduced size of the panel. We have not had sufficient experience with this type of equipment, the number of signal boxes of this kind being very small.

3. — We use one signal lever, with selection over the route levers.

4. — The buttons are mounted on a separate panel.

5. — We have no installations of this type.

6 - 10. — We have not sufficient information to enable us to reply on these points.

11. — We have no electro-pneumatic installations.

12. — Both in the case of the V. E. S. and the « all-electric » Ericsson type signal boxes constant point detection, included in the signalling controlling circuit, is provided.

d) Mozambique Railways.

1. — We use only apparatus having interlocked levers.

2. — We use both systems of induction.

3. — Selection is used to reduce the number of signal levers.

4 - 5 - 6 - 7 - 8 - 9 - 10 - 11 — We have not such systems and cannot reply on these points.

e) Spanish Nacional Railways (Renfe)

1. — Up to the present we have used individual levers mechanically interlocked. The use of free push-button installations is now being investigated, especially in the case of the small stations on main double track lines; we prefer them on account of the small size of the panel needed.

2. — In the case of individual levers mechanical interlocking is considered preferable.

3. — A single signal lever is used, when there are route levers (or handles) to provide means of selection.

4. — In the small installations, we always use the geographical type of panel, with buttons mounted in place on it, as this is more easily understood by the signalman.

5. — We have no installations of this kind.

6. — The reasons are the same as given under 1 above.

7. — The push-button equipment no doubt calls for a higher standard of training on the part of the maintenance staff.

8 - 9 - 10. — We have no information to enable us to reply.

11. — We have no electro-pneumatic installations.

12. — Every pair of facing points is fitted with positive detection controlling the relative signal circuits.

f) Swedish State Railways.

1. — At present all the large installations in Sweden are fitted with electric power frames with interlocked levers and in consequence we are unable to make a comparison between the different types. We are contemplating using the free push-button system in the large stations also.

2. — In the future we shall use only electro-magnetic interlocking of the levers in the large installations.

3. — Yes. We often use one lever only for a home signal, although the signal can exhibit several aspects. The particular aspect to be displayed by it is then determined by the positions of the points through relay action. Likewise a single lever can be used to control several signals leading to the same track.

4. — Only exceptionnally are the buttons mounted in their geographical positions on the panel, but it is proposed to adopt this method in future on an increased scale.

5. — There are no installations of this kind in Sweden. It could only be used for very large layouts.

6. — The advantages of the free push-button arrangement are that there is no replacing of levers to normal after a movement and that the signal box equipment can be smaller. This results in an economy of time in working and, in the large installations, of staff also.

7. — The free push-button types of signal box are built in a manner somewhat different from the old type. In consequence the maintenance requires new technical knowledge on the part of the staff. This is not more complicated or difficult to learn than that required to deal with the older equipment. After receiving suitable instruction the staff has been able to take over the maintenance of the new apparatus without any difficulty.

8. — The equipment is certainly more complicated from the electrical point of

view, but on the other hand it is simpler mechanically. The maintenance of the electrical portion is thus more extensive than before, but there is nothing new involved in principle.

9. — Costs, both for installation and upkeep, are about the same for the two systems. In the case of manufacture on a production basis, the first costs of push-button apparatus should be less than those of other types.

10. — A free push-button installation should be so made that any disturbance in the working caused by a failure should be at least as small as that arising with other types of equipment.

11. — We do not use electro-pneumatic apparatus. Our climatic conditions would not allow of it.

12. — In the case of our interlocked lever installations, it is impossible to lock a route and hence to clear the signal concerned if the position of the points is not in agreement with that of their respective levers. This effect is obtained in the push-button installations by the operation of relays.

g) Hungarian State Railways.

1. — Hitherto we have used the V. E. S. type of apparatus with individual levers.

2. — We have either mechanical or electrical interlocking.

3. — When a signal applies to several routes one lever only is used, and a selection by means of buttons applying to the separate routes is used in conjunction with it.

4 - 5 - 6 - 10. — We have no experience of free push-button type signal boxes.

11. — We have no electro-pneumatic installations.

12. — Constant electric detection is provided for the points, which act positively on the signal control circuits.

C. REMOTE CONTROL AND OPERATION OF POINTS AND SIGNALS BY MEANS OF RELAYS.

Among the managements from whom replies have been received, the only one having anything of this kind in service is that of the Swedish State Railways. The system has been applied to a suburban line 19 km (11.8 miles) long, operated partly as a single and partly as a double track. Its working has proved to be very satisfactory as regards the saving of time when trains are crossing each other, and in consequence of this an extension of the system to a 130 km (80.778 miles) stretch of single line carrying a heavier traffic is being examined.

The *Italian State Railways* has, before the war, been studying the question of putting in an installation for the remote control of several junctions round Bologna but the proposal was afterwards abandoned. The advisability of reconsidering this question is now being looked into, in view of the operating and economic advantages that it would permit of obtaining. It is considered that the most advantageous application of the system (generally called centralised traffic control or C. T. C.) would be on single lines mostly carrying through traffic and with little local traffic, that is few trains running merely between intermediate stations. It is these conditions which have given rise to the preference entertained for the system in America. It is evidently advisable to extend it to many lines in Europe and the question is deserving of much attention and interest, in view of the important advantages which the system can bring with it, even under traffic and other conditions differing from those met with in America.

D. AUTOMATIC SIGNALLING CONTROLLED BY PERMANENT CURRENT OR CODED CURRENT TRACK CIRCUITS.

I. General considerations.

II. Replies received from the following Administrations :

- a) Italian State Railways;
- b) Austrian Federal Railways (ÖBB);
- c) Portuguese Railways;
- d) Mozambique Railways;
- e) Spanish Railways (RENFE);
- f) Swedish State Railways.

I. General considerations.

The only items of information at our disposal on this subject are those referring to the coded current automatic signalling installations in course of installation on the Rome-Naples and Florence-Bologna lines of the *Italian Railways*, which are replacing the earlier ones using permanent currents, which were destroyed.

The advantages of coded currents are essentially of an economic and traffic working character. The coded track circuit allows of transmitting, when it is unoccupied by a vehicle, from the feed end to the relay end, that is to say in a direction contrary to that of the traffic, as many different indications as the codes used, whereas a permanent current, although able to energise the track relay, does not afford the possibility of clearing the signal dependent on it; any other current too which traverses the relay cannot produce an effect prejudicial to safety.

The possibility of transmitting several different indications over the track circuit itself affords means of controlling the signals in the rear while doing away with any overhead line or cable otherwise required for that purpose.

Technical literature shows us also that by using « reverse codes » it is possible to transmit an indication from the relay end to the feed end, in the same direction as that followed by the trains, which can serve to provide some desired control, or to give warning of the approach of a train, but this possibility has not been made use of in the Italian installations.

It is possible to code either continuous or alternating currents, which we may call « carrier currents » by analogy with the

technique used in telecommunications. The coding of alternating currents affords us the possibility of using and amplifying the currents induced by those set up in the rails when the two are short circuited by an axle and to obtain in this way indications which can be transmitted to the locomotive. It follows that the installing of automatic signals controlled by coded alternating currents forms in itself the track equipment necessary for cab signalling. This last very important possibility will be made use of in the Italian installations. Naturally we may equip at once this or that class of locomotive running on the line, or spread the work over a certain time for financial reasons. In this way advantage could be taken of the possibilities offered by the installing of automatic signalling and its track circuits.

Finally, coded track circuits allow of obtaining even over considerable lengths, rather high shunt values, which is obvious, since with coded current it is sufficient for the occupied condition to be brought about if the code following relay cannot pick up, whereas, with the permanent current arrangement it must drop away under the effect of the train shunt.

The frequency of these « carrier » currents in the Italian installations will be of the order of 42 to 50 cycles, that is the same as in industrial electrical installations, which are to be standardised everywhere at a figure of 50. It has not been thought necessary to adopt a special frequency for these currents.

The problem of securing protection against a broken down insulated joint is of the greatest importance, since the choice of one type in preference to another may reduce but can never eliminate this possibility. On steam worked lines the problem does not, however, call for special precautions because for coded current to pass from one section to another both insulated joints between adjacent track circuits must fail simultaneously. On electrified lines, on the contrary, where it is essential to use impedance bonds, the failure of a single joint is sufficient to bring about this possibility. The two impedance bonds, then

become connected in the form of two auto-transformers, one acting as a reducer, the other as a raiser of the voltage, in inverse transforming ratios. The consequences of such a joint breakdown are also different according to whether it occurs at the entry to a block section, or at the caution or distant signal in the rear. In the latter case it could be feared at most that the code might pass via the broken down joint without proving that the signal is illuminated and what indication it is giving. When, however, the failure occurs to the signal at the entrance to the section, the objections that can be advanced from the safety point of view are much more serious, because there is a fear that the most restrictive code being sent to feed the section in the rear when a train is in the section ahead, might, by passing the failed joint, enable the signal there to give permission to a train to proceed irregularly.

If a comparison is made between the first and the second suppositions, it is seen that in the first case also, as has been frequently confirmed by measurements, the coded current which passes from one track circuit to the next in rear, following a failure of a joint, is subject to so great a reduction in strength, even under the highest figures for ballast resistance, that the possibility of the relay of the section in rear being able to follow the code can be ruled out (the voltage at its terminals is less than half that of the drop-away figures). When, on the other hand, an insulated joint fails at the entrance to a section and the coded current passes from the section in rear to the one in advance there is no noticeable reduction and there is without doubt the possibility of the relay for the section in advance following the code.

The arrangements used to protect against such failure consist essentially in verifying by means of a current fed permanently into the circuit in rear of an insulated joint that such joint is not broken down. The feeding of the coded current follows that of this steady current if the joints are in order; if the contrary is the case, either the steady current feed can be maintained or such

substitution be permitted only when the signal at the entrance to the section has been set to give a permanent indication of absolute stop. The second arrangement uses what is called the lock-out stick relay. The two systems which are capable of solving the problem possess the defect that they function by the sending of a current and that this may fail by reason of any kind of interruption to the circuit. Neither is it possible to apply anything that will prove or detect the working of these arrangements. A different solution, which has been adopted for 2-aspect signals at the entrance to a section, consists in making the clearing of a signal dependent on the highest rate of code alone, that is on the one allowing a train to travel at maximum permissible speed. It then follows that the more restrictive code fed to the section in rear when the one ahead is occupied is not capable of altering the stop indication into one authorising the train to proceed.

The solution, which is simple and complete is not applicable when the signal is of the 3-aspect type.

II. Replies received from the Administrations.

a) *Italian State Railways.*

1. — The permanent current type of automatic signalling installations in service before the war which were destroyed, have been replaced by new ones using coded current, at present in course of construction. An alternating « carrier » current at industrial frequency is used, capable of being coded at 75, 120 and 180 periods per minute. In each case, the interval during which current is being applied to the circuit (the on time) is equal — initially that is — to the time when the current is interrupted (the off time).

These installations are on the Rome-Naples and Florence-Bologna lines, both electrified on the 3 000 volt d. c. overhead system.

The longest coded current track circuit

is 2 000 m (2 187 yards). The track circuits within station limits on these lines (between the home and starting signals) are equipped with double element a. c. relays, which are found preferable to- and are being substituted for relays fed through rectifiers (at least in the case of long track circuits), in order to get better protection against the harmonic ripple in the traction circuit, which is fed by hexaphase mercury arc rectifiers (giving the 6th, 12th, 18th harmonics of the feed frequency).

The longest track circuit in the station itself is about 800 m (874 yards) long, in the case of two element relays, and 400 m (437 yards) when the rectifier fed relays are used.

The shunt values obtained with permanent feed type track circuits in stations are :

For a track circuit 300 m (328 yards) long 2.7 ohms.

For a track circuit 600 m (656 yards) long 1.8 ohms.

For a track circuit 900 m (984 yards) long 1.0 ohm.

The shunt values obtained with the coded track circuits used to control the automatic signals are :

For a track circuit 600 m (656 yards) long 0.35 ohm.

For a track circuit 1 000 m (1 093 yards) long 0.20 ohm.

For a track circuit 2 000 m (2 187 yards) long 0.15 ohm.

When these circuits are fed by permanent current the shunt values fall respectively to about 0.18, 0.10 and 0.07 ohm.

It is interesting to note that after having adjusted the circuits to ensure that the relays will make their top contacts with a drop in voltage of 10 % and the maximum loss through the ballast, the value of the shunt is always taken with minimum ballast loss and maximum feed voltage.

2. — The special advantages of using coded currents are :

a) sensitivity to the shunt, which can be obtained even with very long circuits;

b) security against any fusing of relay contacts and the influence of any other currents in the rails;

c) the possibility of transmitting several different indications over a clear track circuit and of controlling signals without having to use line wires;

d) the possibility of immediately adopting cab signals, as soon as the a. c. current is coded.

3. — Sufficient information is not available to enable a comparison of this sort to be made.

4. — From the safety point of view the considerations set forth in 1 above apply. No actual working experience has yet been obtained enabling the question of regularity of operation to be dealt with.

5. — The supply feed is of the a. c. type. Transformers carried on suitable lineside supports are fed from a 10 000 line passing along the railway, which connects with the traction sub-stations. The track circuits are fed from the secondaries of these transformers.

The track circuits in the stations are fed from the various low voltage supplies, and from the 10 000 volt supply through transformers; in addition there are converter sets, fed from lead type storage batteries.

6. — The distance between the signals controlling the entrance to two successive sections is from 4 to 5 km (2.486 miles to 3.1 yard).

7. — The frequency of the track circuit feed, either for the automatic sections or the station installations is from 42 to 50 Hz. A frequency of 75 Hz. has also been used, but only on lines worked by a. c. traction at a frequency of 16.7 Hz.

In the case of single rail track circuits, the feed connections are always transposed, as between adjacent track circuits. With the double element a. c. relays this always gives rise to a reverse torque in the relay ro-

tor or vane when an insulated joint breaks down, and this can only produce the « track occupied » condition.

In the two installations of automatic signalling mentioned and where impedance bonds are used on electrified sections, arrangements have been made under which a test permanent current is applied to the circuit before the coded current. If a joint breaks down this prevents the former being followed by the latter. In another arrangement the coded circuit replaces the permanent current after the signal concerned has been set to show permanently its most restrictive indication.

8. — Insulated joints are made with the aid of vulcanised fibre or paper or bakelised cloth, or are formed of laminated wood fishplates impregnated with synthetic resin.

9. — No experience is available in the case of coded currents. For automatic signalling controlled by permanent current track circuits a ratio of G/N of the number G of failures to the number N of train signal movements, of the value of 0.000062 was obtained, and a ratio F/N (where F is the number of times trains are stopped) of 0.000154.

10. — There are no similar cases of lines worked by automatic signalling. It would be possible to have telephonic warning from the block post in rear of the junction, or better still, coded circuits giving the description of an approaching train (*train describers*).

11. — Permissive signals have a black letter P on a white background below the signal lights. A driver finding such a signal at stop must stop and after waiting 10 minutes proceed after receiving the guard's written order to do so, with caution and not exceeding a speed of 25 km/h (15 m. p. h.), as far as the next station.

b) Austrian Federal Railways (O.B.B.)

1. — Track circuits fed by permanent d. c. current are used not exceeding 3000 m (3 280 yards) in length.

2 - 3 - 4. — There are no coded track circuits in use. The system used hitherto leaves nothing to be desired from the safety point of view.

5. — The track circuits are battery fed.

6. — The average distance between two successive signals is 3 000 m.

7. —

8. — Insulated joints made of wood and synthetic resin are used.

6. — The average distance between signals is 3.5 km (2.17 miles).

7. —

8. — Insulated joints made of an impregnated material are used.

9. — There are 8 failures per signal per annum.

10. — Automatic signals may be passed with caution when at danger by a driver after a wait of 3 minutes.

c) Portuguese Railways

1. — Automatic signalling installations are at present being designed, using permanent a. c. feed, in view of the lines being electrified. The length of the track circuit will be about 800 m (874 yards).

2 - 3 - 4. — Coded current installations have not been used.

5. — A. C. supply will be used.

6. — The distance between signals depends on the length of the sections and therefore on the density of the traffic. The average length will be 1 200 m (1 312 yards), and the maximum 2 500 m (2 734 yards).

7. —

8. — The Weber type joint is preferred generally. It has proved very satisfactory, but the cost of it is high, and replacement difficult. American type joints are being tried experimentally.

d) Mozambique Railways.

1. — The track circuits are battery fed with permanent current at 12 volts. The relays are 4 ohms resistance.

2 - 3 - 4. — No reply to these questions.

5. — The feed is taken from batteries in parallel charged from the mains (floating battery arrangement).

e) Spanish National Railways (Renfe).

1. — There are installations of automatic signalling with permanent a. c. track feed and impedance bonds on electrified lines or those to be electrified. The maximum length of track circuits is 1 500 m (1 640 yards) on steam lines.

2 - 3 - 4. — There are no coded installations.

5. — The track circuits are fed by a. c. through transformers from a 2 200 volt supply running alongside the track. There are also some independent generating sets which start up and take over in the event of the main supply being interrupted.

6. — The average distance between successive signals is 1 500 m (1 640 yards) or 1 200 m (1 312 yards) according to whether steam or electric traction is used.

7. —

8. — Weber type insulated joints are used.

9. — There are 0.39 failures per year per signal.

10. — A telegraphic or telephonic advice of trains is given when there is any change in their regular order.

11. — Permissive automatic signals have a fixed blue light, carried on the post below the main signal light and staggered with respect to it.

f) Swedish State Railways.

1. — At present only d. c. type permanent current track circuits are used. With counterfeed it is considered that maximum length is between 2 000 and 2 500 m (2 187 yards and 2 734 yards).

1. — The chief disadvantage of using d. c. for the track circuits is the risk of disturbance on electrified lines where single rail track circuits are used. For this reason the use of a. c. track circuits is contemplated. By choosing a suitable frequency all risk of extraneous influence can be eliminated, whether permanent or coded a. c. current is adopted. When installing the a. c. system cab signalling can be added if need be.

3. — If the use of alternating current will eliminate all interference no purpose is served by making a comparison between d. c. and a. c. track circuits.

4. — See the reply to points 2 and 3 above.

A system using three different frequencies instead of a single coded frequency is at present being investigated. It is thought that it will require less maintenance.

5. — The present permanent current track circuits are fed from primary batteries or through rectifiers connected to the a. c. mains. It is intended to use the mains supply for any future track circuit installations.

6. — About 2.5 km (1.553 miles).

7. — The investigation of these problems is not yet completed.

8. —

9. — One or two.

10. — By using a « Train describer ».

11. — This method of signalling is not used in Sweden where normally there is no need to pass a stop signal.

INTERNATIONAL RAILWAY CONGRESS ASSOCIATION

15th. SESSION (ROME, 1950).

QUESTION XIV.

Change over from steam-locomotive traction to Diesel traction.

REPORT

(America (North and South), Burma, China, Egypt, Great Britain and North Ireland, Dominions, Protectorates and Colonies, India, Iran, Iraq, Malay States and Pakistan.)

by A. W. OLIVIER,

Chief Engineer, Traction Department, Netherlands Railways, Utrecht.

In the following report technical and constructional details of the locomotives and rail-cars will not be dealt with, but the subject will be treated from a point of view of operating and maintenance. Therefore a short summary of the types and dimensions only will be given.

Successively locomotives for train-service, locomotives for yard service (shunting, switching) and rail-cars will be discussed.

Of the 26 Administrations to which the questionnaire was sent, 13 gave no reply; 5 of them had no Diesel experience and 3 were not able to compile an answer. As a result this report has had to be composed out of information from the Pennsylvania Railroad Company, the British Railways, the Ceylon Government Railway, the Railway Board of India and the Victorian Railways, supplemented with some general information.

Locomotives for train-service.

INTRODUCTION.

From the answers received, it appears that the use of Diesel-locomotives for road-service in most countries is experimental or in preparation. Only in the U.S.A. is this

new form of motive power used on a large and daily increasing scale.

On the Pennsylvania for example the first passenger-engine started operating in September 1945, and by the end of 1949 there were already 63 Diesel-electric locomotives in passenger service.

Freight engines entered in July 1947, and now there are 82 Diesel-electric freight locomotives on the line.

The New York Central began in 1944 and on 1st Jan. 1947, this system had 145 units of 1 350 to 2 000 HP in service or under construction.

The Southern Pacific obtained its first Diesel-electric road locomotives in 1947, and in 1949 the newly built Taylor Yard maintenance shop at Los Angeles was already responsible for 49 passengers - and freight locomotives, representing 179 units of 1 500 and 2 000 HP, whilst 6 more units for this terminal were under construction. (See Table I.)

As result, the following information is mainly based upon American practice and opinions, but there is no reason at all why it should not be of value for other Railroads to a certain extent.

Although successful types of Diesel-electric yard-locomotives have been known before,

TABLE I.
Diesel-electric locomotives for train service 1949.

Class	HP	Units per loco-motive	Weight per locomotive (lbs.)		Tractive effort (lbs.)		Axle arrangement	First in service	Number in service	Remarks
			Working order	On drivers	Max.	Cont.				
1. Pennsylvania Railroad Company.										
a) Passenger-service.										
BP 1	6 000	2	1 187 420	818 000	204 500	105 600	2 (2Do-Do2)	1947	63	Non separable
AP 2	4 000	2	618 300	412 700	103 175	—	2 (A1A-A1A)	1947		—
AP 3	6 000	3	931 300	620 800	155 200	81 000	3 (A1A-A1A)	1947		—
BP 2	4 000	2	761 600	507 200	126 800	—	2 (A1A-A1A)	1948		—
BP 3	6 000	3	1 148 700	764 400	191 000	79 200	3 (A1A-A1A)	1948		—
EP 2	4 000	2	625 700	421 700	105 425	—	2 (A1A-A1A)	1945		—
EP 3	6 000	3	1 017 240	705 000	176 250	82 500	3 (A1A-A1A)	1948		—
b) Freight-service.										
AF 4	6 000	4	959 600	959 600	239 900	170 000	4 (Bo-Bo)	1948	82	—
BF 3	4 500	3	789 000	789 000	197 250	—	3 (Bo-Bo)	1949		—
BF 4	6 000	4	1 046 000	1 046 000	261 500	172 000	4 (Bo-Bo)	1949		—
EF 2	3 000	2	472 800	472 800	118 200	—	2 (Bo-Bo)	1948		—
EF 3	4 500	3	710 800	710 800	177 700	127 500	3 (Bo-Bo)	1948		—
EF 4	6 000	4	930 000	930 000	232 500	130 000	4 (Bo-Bo)	1947		—
FF 2	4 000	2	710 320	491 440	122 860	—	2 (A1A-A1A)	1947		—
FF 3	6 000	3	1 064 420	736 580	184 145	123 000	3 (A1A-A1A)	1947		—
2. British Railways.										
a) London Midland Region.										
—	1 600	1	—	—	41 400	15 000	—	1948	2	{ Experimental Multiple unit
b) Southern Region.										
—	1 750	1	260 000	216 000	31 000	?	1 Co-Co1	—	—	2 under constr.
—	1 750	1	288 000	288 000	31 000	?	Do-Do	—	—	1 under constr.
3. Ceylon Government Railway.										
—	750	1	—	—	—	—	—	—	—	25 on order
4. Victorian Railways.										
—	1 500	1	240 000	240 000	60 000	45 000	Co-Co	—	—	{ 17 in preparat. Multiple unit

we must take 1934 as the year in which the first efficient Diesel-electric passenger engine went into service on the Chicago, Burlington and Quincy Railroad.

It concerned a 600 HP unit, forming part of a fixed trainset. The results obtained with this new long-distance train were such as to draw much attention all over the United States.

As first undertakings the Atchison, Topeka and Santa Fe and the Baltimore and Ohio asked for separate Diesel-electric locomotives that could pull any kind of passenger train, consisting of normal rolling stock.

The first demonstration model was brought out in 1935, being a two-car 3 600 HP locomotive. With this engine the A. T. and S. F. established the famous 39 3/4 hour service between Chicago and Los Angeles, cutting the time from the previous schedule of 56 hours, giving a reduction of about 30 %.

Shortly afterwards other U. S. A. railroads followed, and from this moment a quick development of the different standard types and their use started.

By the end of 1939 the same story repeated itself with regard to engines for freight service, stimulated by the need of quick and reliable long-distance road-power during world-war II.

Typical of the tendency in the U. S. A. is, that in 1946, about half the total number of steam-locomotives being 30 years or more old, 856 Diesel-locomotives were in construction against only 55 steam-locomotives.

On November 1st 1946 all U. S. A. railroads together disposed of :

37 575 steam-locomotives,
3 352 Diesel-electric locomotives,
741 Electric locomotives.

On June 1st, 1947, the number of Diesel-locomotives had already risen to 3 820, divided as follows :

locomotives for yard-service, 600
— 1 000 HP 2 730
locomotives for train-service, 1 000
— 8 000 HP 1 090
Total. . . 3 820

For the year 1948, there were approximately 2 100 Diesel-electric locomotives ordered, while the total number of steam-locomotives on order amounted only 69.

Since then the considerable development of this new form of road-power has increased more and more, and at the moment it is only limited by the capacity of the manufacturers.

Fuel-consumption.

The total thermal efficiency of the Diesel-electric locomotive is about fourfold that of the modern coal-fired steam-locomotive. As a matter of fact by judging the value of this proportion, we have to take account of the local possibilities to obtain either suitable coal, or Diesel-fuel, as well as of the price of coal on tender and diesel-fuel, in the locomotive tank.

From a paper read before the American Society of Mechanical Engineers, in Chicago, in June 1947 (*), the following information were taken :

Locomotive type	Useful work, percentage of total heat-input
Modern coal-fired steam	6.7
Diesel-electric	26.4

This means a heat input of 38,135 B. T. U. per Rail HP-Hour for the steam locomotive, against 9,665 B. T. U. per rail HP-h for the Diesel-electric locomotive (fig. 1 and 2).

Based upon the average coal — and diesel-fuel prices (freight and handling included) and calorific value in the U. S. A. about that time, this resulted in net fuel costs per rail HP-h of \$ 0.00571 for

(*) « The coal-fired gasturbine power-plant » by JOHN I. YELLOTT and CHARLES F. KOTT CAMP, published by the *Locomotive Development Committee*, Baltimore.

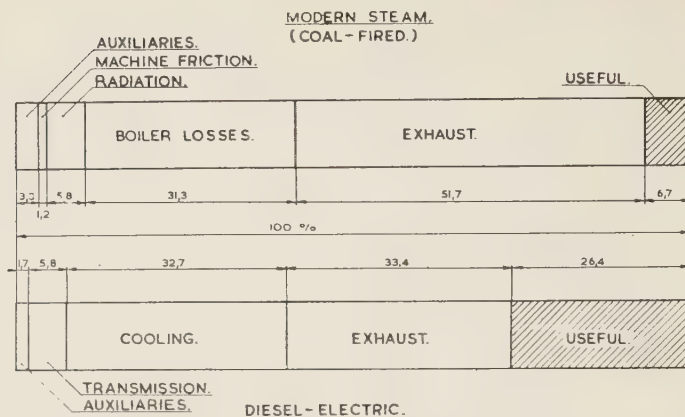


FIG. 1. THERMAL EFFICIENCY.

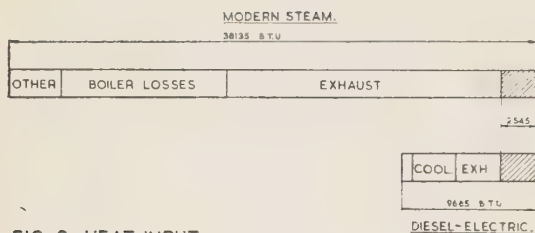


FIG. 2. HEAT INPUT. B.T.U. / RAIL HP-HR

steam and \$ 0.00484 for Diesel-electric, showing an advantage of about 15 % for Diesel versus steam.

It is clear, that local — and market conditions may have a big influence upon this relation.

Of the consulted Administrations only the *Pennsylvania Railroad Company*, furnished valuable information about fuel-consumption and costs of steam and Diesel roadpower in freight — and passenger service, based on the year 1948, as follows :

Amount and costs of fuel consumed per rail HP-h
using the locomotives with full load.

	Freight locomotives		Passenger locomotives	
	steam	Diesel	steam	Diesel
Nominal horsepower	—	4 500	—	4 000
Rail horsepower	4 140	4 140	3 680	3 680
Fuel burned per hour (lbs.)	13 500	1 800	10 700	1 600
Fuel burned per hour (tons or gal.) (*)	6.75	252	5.35	224
Unit cost of fuel (dollars)	5.12	0.108	5.12	0.108
Cost of fuel used per hour (dollars) . .	34.58	27.22	27.40	24.19
Cost of fuel per rail HP-h. (dollars) . .	0.00834	0.00658	0.00745	0.00658

(*) American gallons. 1 American gallon = 0.83, British gallon = 3.8 liters.

This shows a gain in net fuel-costs of 21 % in freight service and of 11 1/2 % in passenger service of Diesel versus steam, which is in accordance with the all-over average gain of 15 % calculated in the above

mentioned publication.

As an example of the influence of local prices we give the following short summary, based on the same thermal efficiency and 1949 conditions in the Netherlands :

	Locomotive coal	Diesel-fuel
Cost of fuel on tender or in loco. tank. . .	Gld. 42 (1 000 kg)	Gld. 86 (1 000 l)
Average calorific value	7 500 cal	10 000 cal
Heat input per 1 rail HP/h	9 437 cal	2 395 cal
Cost of fuel per 1 rail HP/h	Gld. 0.0528	Gld. 0.0242
Gain in net fuel costs Diesel versus steam : 54 %.		

TABLE II.
Average fuel-consumption Diesel-electric locomotives.

13 American Railroads June 1947. <i>Passenger-service.</i>			
	Maximum	Minimum	Average
Average miles per loco-unit per month	18 382	9 952	14 514
Average train-miles per train-hour	56.4	35.5	45.4
Average passenger-cars per loco-unit mile	6.8	2.7	5.6
Average horsepower per loco-unit	2 000	1 416	1 851
Fuel consumption { per passenger-car mile (*)	0.37	0.24	0.27
(Am. gallons) { per loco-unit mile	1.99	0.84	1.52
Fuel costs { per passenger-car mile . .	2.53	1.63	2.06
(dollars, cents) { per loco-unit mile	14.28	6.87	11.48
11 American Railroads June 1947. <i>Freight-service.</i>			
	Maximum	Minimum	Average
Average miles per loco-unit per month	12 254	4 843	9 013
Average train-miles per train-hour	29.6	21.8	24.4
Average ton-miles per loco-unit mile	1 388	636	999
Average horsepower per loco-unit	1 500	1 324	1 356
Fuel consumption { per 1 000 ton-miles . .	2.29	1.39	1.71
(Am. gallons) { per loco-unit mile	2.14	1.44	1.73
Fuel costs { per 1 000 ton-miles . . .	19.37	10.21	12.48
(dollars, cents) { per loco-unit mile	17.31	8.00	12.61

(*) Average weight of modern passenger-cars 50-60 tons.

TABLE III.

Average operating costs Diesel-electric locomotives.

13 American Railroads June 1947.					
Passenger-service.					
a) per passenger-car mile.					
			Maximum	Minimum	Average
Repairs	(dollars, cents)	Diesel-engines	1.60	0.40	1.04
»	(»)	Electrical	1.16	0.20	0.69
»	(»)	Others	1.35	0.51	0.93
»	(»)	Total	3.58	1.28	2.72
Fuel	( » )	. . . . .	2.53	1.63	2.06
Lubricants	( » )	. . . . .	0.41	0.10	0.17
Total	( » )	. . . . .	6.14	3.57	4.95
b) per loco-unit mile					
Average HP per loco-unit			2 000	1 416	1 851
Repairs	(dollars, cents)	. . . . .	21.32	4.36	15.12
Fuel	( » )	. . . . .	14.28	6.87	11.48
Lubricants	( » )	. . . . .	2.16	0.14	0.97
Total	( » )	. . . . .	36.59	11.37	27.57

11 American Railroads June 1947					
Freight-service					
a) per 1 000 ton-miles.					
			Maximum	Minimum	Average
Repairs	(dollars, cents)	Diesel-engines	7.46	2.92	4.52
»	(»)	Electrical	5.01	0.86	2.82
»	(»)	Others	6.58	1.23	2.99
»	(»)	Total	16.42	5.48	9.71
Fuel	( » )	. . . . .	19.37	10.21	12.48
Lubricants	( » )	. . . . .	1.85	0.53	1.09
Total	( » )	. . . . .	37.64	16.86	23.28
b) per loco-unit mile.					
Average HP per loco-unit			1 500	1 324	1 356
Repairs	(dollars, cents)	. . . . .	18.94	5.89	9.70
Fuel	( » )	. . . . .	17.31	8.00	12.61
Lubricants	( » )	. . . . .	1.58	0.51	1.11
Total	( » )	. . . . .	34.39	17.09	23.42

The secondary advantage of the fuel type, as there are transportation, loading and unloading, storage, ash-handling and so on, will be treated later.

For general information Table II gives

some statistics about average fuel-consumption and — costs of Diesel-electric locomotives in normal train-service of a certain number of U. S. A. Railway-undertaking. It is regrettable, that we cannot dispose of comparable data for steam locomotives.

Operating and maintenance costs.

As primary reason for the change-over from steam to Diesel-traction in train service, the Pennsylvania Railroad Company indicates the rapidly increasing costs of maintenance and operation of steam-locomotives.

The ratio of savings from the use of Diesel-electric road-engines versus steam-locomotives on this system, being about 5 % prior

to world war II, has been increased to approximately 30 % after this war, and is still showing a further tendency to rise.

In the year 1948, the approximate operating costs per locomotive-mile, including repairs, fuel, lubricants, water, other supplies and engine-house expense for both types of motive power, in passenger - and freight service on the Pennsylvania Railroad compare as follows :

	Steam			Diesel			Savings Diesel v. steam
	Year built	HP	Cost p. mile	HP	Units	Cost p. mile	
Passenger service	1946	5 400	\$ 1.4672	6 000	3	\$ 0.9781	34 %
Freight service	1945	6 540	\$ 2.0169	6 000	4	\$ 1.1136	45 %

These figures, confirming the above mentioned rise of savings in favour of the Diesel-electric road power, are of a certain value, because they give a comparison between the operating costs of *modern* engines of both types.

Table III shows a summary of the average operating costs of Diesel-electric locomotives in passengers - and freight service on a certain number of U. S. Railroads during the month of June 1947, from which we can calculate the costs per mile for 6 000 HP in passenger-service to be about \$ 0.893, and in freight-service \$ 1.036.

Making allowance for the fact that the statistics of Table III only comprise repairs, fuel and lubricants, we may say that these figures are in good accordance with those of the Pennsylvania Railroad.

Availability and utilization.

Availability is the total time a locomotive is available for service, either working trains or ready to start immediately. To fix the percentage of availability we have to reckon with all time needed for over-

haul, repairs, inspections and servicing of the engine. As a matter of fact we may not base it upon the scheduled runs, because in many cases there will be enough time left between the latter to carry out servicing and certain mileage-inspections, giving an inaccurate and too optimistic picture of the availability.

With the help of good organization of the maintenance and servicing, increasing the mileage between inspections and overhauls, speeding up inspection — and repair-work by the use of well organised maintenance — and repair-shops, taking advantage of the large possibilities of exchanging parts of standardized engines, it is possible to increase the availability.

Utilization is the total time a locomotive is working. It will be clear that, as well for steam as for Diesel, everyone will try to make the difference between availability and utilization as small as possible. This depends largely upon the organization of the schedules, and the length of the runs without engine-change.

After a long and heavy run a Diesel-electric locomotive is practically immediately available for a new assignment, and

only wants refuelling, sanding and some watering, which can be done in a very short time.

A steam-engine on the contrary, after such a run wants much more care, and has to be prepared thoroughly for a new job.

Typical examples of this kind are found on the Pennsylvania Railroad. When the Diesel-electric locomotive pulls up at St. Louis after an 856 mile run from its base at Harrisburg, it makes a secondary round trip of 480 miles to Indianapolis, before returning to Harrisburg, thus accomplishing a total trip of about 2 200 miles out and home.

After the 713 mile run from Harrisburg, to Chicago we find an identical sidetrip of 233 miles, bringing the total trip length to about 1 900 miles.

This tendency to «keep the engines moving» between the mileage-inspections is found everywhere in passenger - and freight service, and as a matter of fact can be realized better with Diesel-locomotives than with steam-locomotives.

Based on the 1948 performances, the

Pennsylvania Railroad Company gave following informations :

Average mileage per locomotive per month

	Steam	Diesel
Passenger-service . . .	3 881	17 752
Freight-service	2 553	9 511

Average time required for periodic inspections per month.

Steam	50 hours
Diesel	10 hours

Average time for daily inspections and repairs.

Steam	8 ½ hours
Diesel	5 ½ hours

Supposing the complete servicing included in these figures, this leads to the following calculation of the *availability* of all Pennsylvania Railroad passenger — and freight-road engines :

	Steam	Diesel
Total hours per month	720	720
Less for periodic inspections	50	10
Less for daily inspections and repairs	255	165
Less total hours	305	175
Total hours available	415	545
Percentage availability	57.6	75.7

The utilization was determined as follows :

	Steam		Diesel	
	Passenger	Freight	Passenger	Freight
Total hours per month	720	720	720	720
Average miles/hour when working	45	20	45	20
Average miles per month	3 881	2 553	17 752	9 511
Total hours utilized	86.2	127.6	394.5	475.5
Percentage utilization	12.0	17.7	54.8	66.0

When comparing these figures, we must realize, that they refer to new Diesel-electric locomotives in selected schedules against steam-locomotives of different age, partly in less favourable service. A certain number of the latter will require more maintenance than modern engines, thus influencing the availability and utilization in favour

of Diesels. A comparison of only modern power in equivalent service without doubt would give better figures for the steam-locomotives, as shown below.

This finds expression too in the average and maximum length of scheduled locomotive-runs without engine-change mentioned by the Pennsylvania Railroad :

	Average (miles)		Maximum (miles)	
	Steam	Diesel	Steam	Diesel
Passenger-service	107	588	314	856
Freight-service	130	429	235	924

As an example of the possibilities of Diesel-electric locomotives on the point of long-distance runs may be mentioned the Atchinson, Topeka and Santa Fe passenger service between Los Angeles and Chicago, covering a distance of about 2 200 miles without engine-change, only refueling three times at the head of the train, during scheduled halts in stations.

According to publications of the New York Central System (*) a comparison of the performances of two 4-unit 5 400 HP Diesel-electric freight locomotives and two modern steam freight locomotives of about the same capacity in comparable service has been made for a period of seventeen days in October 1944. During this period the engines of both types were given special

attention, and all possible was done to keep them in service and avoid delays at terminals.

Similar comparison with the same care was made between two 2-unit 4 000 HP Diesel-electric passenger engines and six 6 000 HP modern steam passenger locomotives in the express-service between Harmon and Chicago, a distance of about 900 miles, for a period of fifteen consecutive days in October 1946. In both cases the weather was favourable.

With a certain allowance for less favourable conditions Mr. KIEFER comes to the conclusion that following *maximum performances* may be expected for both types : (see table below).

Regarding the fact that these figures concern modern power in selected service, the availability both for steam and Diesel is in harmony with the over-all availability on the Pennsylvania Railroad shown above.

It will be clear, that the utilization of steam-locomotives determined in this way,

	Steam		Diesel		Diesel advantage	
	Passenger	Freight	Passenger	Freight	Passenger	Freight
Annual mileage	288 000	102 000	324 000	120 000	12.5 %	17.6 %
Average mileage per month .	24 000	8 500	27 000	10 000	12.5 %	17.6 %
Availability, percentage . . .	69.0 %	65.7 %	74.2 %	73.5 %	7.5 %	11.9 %
Utilization, percentage . . .	63.0 %	63.6 %	70.4 %	70.1 %	11.7 %	10.2 %

(*) A practical evaluation of Railroad Motive Power, by P. W. KIEFER, Chief Engineer Motive Power and Rolling Stock, New York Central System, published by Simmons-Boardman Publishing Corporation, New York, 1947.

TABLE IV.
Average availability and utilization of Diesel-electric locomotives.

13 American Railroads June 1947. <i>Passenger-service.</i>			
	Maximum	Minimum	Average
Average miles per loco-unit per month	18 382	9 952	14 514
Average horsepower per loco-unit	2 000	1 416	1 851
Percentage availability	97.2	70.6	78.9
Percentage utilization	70.9	37.4	54.5
11 American Railroads June 1947. <i>Freight-service.</i>			
	Maximum	Minimum	Average
Average miles per loco-unit per month	12 254	4 843	9 013
Average horsepower per loco-unit	1 500	1 324	1 356
Percentage availability	91.0	72.9	83.9
Percentage utilization	83.6	49.3	61.7

is much higher than the over-all utilization calculated by the Pennsylvania Railroad, because the latter concerns a great number of steam-locomotives of all classes and ages, in all kinds of schedules.

In this respect it may be of interest to mention that on the Netherlands Railways, in the year 1949, the average availability of all classes of steam-locomotives was about 60 %, with an average utilization of 16 — 16 1/2 %.

With an increasing number of Diesel-electric locomotives put in service, the utilization-percentage must go down by lack of suitable assignments, but under all

circumstances better utilization than with steam-locomotives can be expected.

For general information Table IV gives a summary of the average availability and utilization of Diesel-electric road locomotives in passenger- and freight-service on a certain number of U. S. A. Railroads during the month of June 1947.

First cost, total and per rail-HP.

Diesel-electric locomotives of about the same rated Horse Power are much more expensive than steam locomotives, as demonstrated by following information, given by the Pennsylvania Railroad Company.

	Steam locomotives					
	Class	HP	Year	First costs	Costs per HP	Annual charges
Passenger	T 1	5 408	1946	\$ 241 596	\$ 44.67	8.41 %
Freight	Q 2	6 540	1945	\$ 220 430	\$ 33.70	8.50 %
Diesel-electric locomotives						
Passenger	EP 3 (*)	6 000	1947	\$ 613 803	\$ 102.30	9.89 %
Freight	EF 4 (*)	6 000	1948	\$ 651 240	\$ 108.54	9.78 %

(*) See Table I.

This shows that the price per HP for Diesel-power is about 2 to 3 times as high as for steam-power.

When judging these figures however, we must realize that, owing to the power characteristics, it will be possible to handle the same train with less Diesel HP than steam HP, and that double heading or helper service on gradients can be eliminated.

The Pennsylvania Railroad furnished detailed statistics about detentions to freight and passenger-trains, due to Diesel-electric locomotive failures over the first nine months of 1949, too elaborate, however, to be reproduced here. From these we may conclude, that there are no special troubles inherent in this form of motive power. During that period the average was 1.0 case on every



Fig. 3.

Reliability.

In comparison with the steam-locomotive the multiple-unit Diesel-electric locomotive shows a marked advantage in the case of failures of machinery parts. In most cases it will be possible to put a defective unit out of service, and to reach the next station without great delay. Units needing heavy repairs can easily be separated and replaced by spare units, thus keeping the locomotive running.

10 000 locomotive-miles in freight-service and 1.8 case on every 10 000 locomotive-miles in passenger-service, causing an average loss of time of 42.5 minutes for each case.

Servicing, running maintenance and repairs.

Together with the rapid development and standardization of the Diesel-electric road locomotives in the U. S. A., a new

type of running maintenance- and repair-shop has been born.

The facilities necessary for a speedy and efficient handling of this new form of motive power, to obtain the utmost availability, are so different from those required for steam-locomotives, that several new shops and installations have arisen in many important Diesel-terminals all over the United States during the last five years. This

Servicing platform.

As a rule we find a so-called servicing platform near the shop in every important Diesel-terminal, where all incoming locomotives are handled before starting on a new trip, or entering the shop for maintenance.

In the modern Diesel-depot of the Pennsylvania Railroad Company at Har-



Fig. 4.

more so, because the existing standard-type of round house cannot be used for stalling multi-unit locomotives without dividing the latter into separate units, which is possible, but undesirable for more than one reason.

Turntables, coal- and water-storages with their auxiliaries, as well as ashpits and dumps are no longer needed, giving an important gain in surface area. The supplying of Diesels with fuel, cooling water, lubricants and sand, can easily be concentrated within a small space.

risburg, Pa., completed in January 1949, this platform is 40 ft. wide and 380 ft. long, with two tracks, centers 19 ft. apart. Complete servicing is done as locomotives move past on one of these tracks.

Fig. 3 gives a general view of the 270 ft. servicing platform, built on the same principles, of the Atchison. Topeka and Santa Fe Diesel-depot at Barstow, California, erected in 1945 as one of the first, if not the first, modern installations for the maintenance of Diesel-electric road-power.

Servicing starts on the receiving end of

the platform with delivering of sand to all sand-boxes of each unit at one spotting. Fig. 4 and 5 show the sanding facilities at Barstow.

Next, the engines are supplied with fuel and cooling-water. For this purpose there are 6 to 8 fueling spots 30 — 35 ft. apart on the concrete platform between the tracks. At Harrisburg each fueling point embodies a group of 5 vertical pipes, there being 2

refueling will not take more than 3 to 4 minutes.

The fuel-oil at Harrisburg is stored in five storage tanks near to the shop area, each tank holding 67 000 American gallons. The oil is brought there in tank-cars, and unloaded by means of two electrically operated unloading pumps with a capacity of 300 gallons per minute each. The unloading is accomplished on a two track



Fig. 5.

fuel-pipes, 2 water-pipes and 1 fire-foam pipe in each group, enabling two engines to be handled, each on its own track, at the same time. The fuel and water is delivered by hose pipes with quick-assembly connections and trigger-type nozzles (Fig. 6), the rate of delivery being 1 000 American gallons (834 British gallons; 3 787 liters) per minute.

The capacity of the fuel tanks of each locomotive-unit being as a rule about 1 200 American gallons, it is clear that complete

unloading station with 16 connections (Fig. 7).

At some distance there is a big emergency-storage connected by a 6 inch. pipe-line with the fueling stations of both Harrisburg and Enola, and installed to be used either in one or in the other direction. All fueling and unloading pumps, together with the foamite equipment, are installed in a pumphouse next to the storage-tanks. Fire-foam pipelines lead to all sections of the Diesel-terminal area.

To end the servicing, the engines go through an automatic engine-washer and a rinsing machine which washes and rinses, the locomotive while passing at a speed of about 80 ft. per minute, taking again 3 to 4 minutes for cleaning the complete engine.

During the servicing, when not due for mileage-inspection in the shop, the loco-

ing periods of lubricating oil, otherwise based on mileage, and in certain cases not yet necessary.

After passing the servicing platform the locomotives due for mileage-inspection or wanting repairs, enter the running-maintenance or repair-shop.

Running maintenance shop.

As a rule the running maintenance shop is combined in one building with the heavy repair-shop, although in certain cases existing steam facilities have been changed to carry out repairs of more importance to separate units.

Fig. 8 and 9 show a basic ground plan and section of a modern combined running maintenance and heavy repair shop for multiple-unit Diesel-electric locomotives, as developed and recommended by the Electromotive Division of General Motors.

In the running maintenance part, we find a certain number of tracks, each of them with sufficient length to spot a complete three — or four-unit locomotive. The length of these engines varying from 200 — 220 ft. the normal track length is about 215 — 230 ft.

The tracks, having their centers 20 — 26 ft. apart, are provided with normal inspection pits, well drained and well lighted. Between the tracks the working floor is depressed, about 30 — 38 inches below rail-level, to facilitate inspection of and working at trucks, traction-motors, running gear and brakes (Fig. 10). Above this depressed floor elevated platforms at engine-room level run full length along the tracks. The standardization of the locomotives makes it possible to make them fit exactly between these platforms. All work in the engine-rooms is carried out from the platforms, on which benches enable small repairwork to be effected. Filters and defective parts are replaced by parts from the store-room, and pass themselves through the cleaning-room, reconditioning- and repair-room to the stores, thus reducing the maintenance time of the locomotive. To facilitate the inspection and repair-work on the depressed

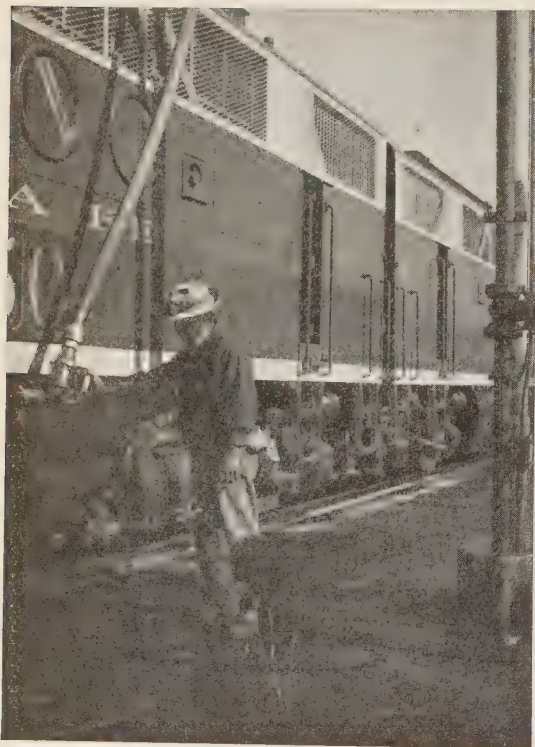


Fig. 6.

tives are visually inspected before going out for a new assignment. Some systems take samples of lubricating oil and cooling water from each engine when arriving at the servicing-platform. Analyses are made in the control-laboratory of the depot, before dispatching the locomotive on a subsequent trip thus preventing deficient conditions causing damage. This type of control has the advantage of permitting extension of drain-

floor ample electric lighting is provided under the elevated platforms. (Fig. 11.)

In the new Pennsylvania maintenance shop at Harrisburg there is even a second elevated platform on engine roof level.

biggest motor-trucks, and special arrangement for lowering one axle with traction motor (Fig. 13 and 14), extends if possible across all tracks, and leads either into the adjoining repair-shop or to the



Fig. 7.

Serving two tracks and the platform between them 1 — 2 tons travelling hoists are installed to facilitate repair-work in the engine-rooms. (Fig. 12.)

A drop pit with tables of sufficient dimensions and capacity to handle the

outside truck release track. Body supports with sliding retractable bars are placed next to the drop pit tables.

At the end of the tracks the platforms joint into one and on the same level space is provided for the cleaning room,

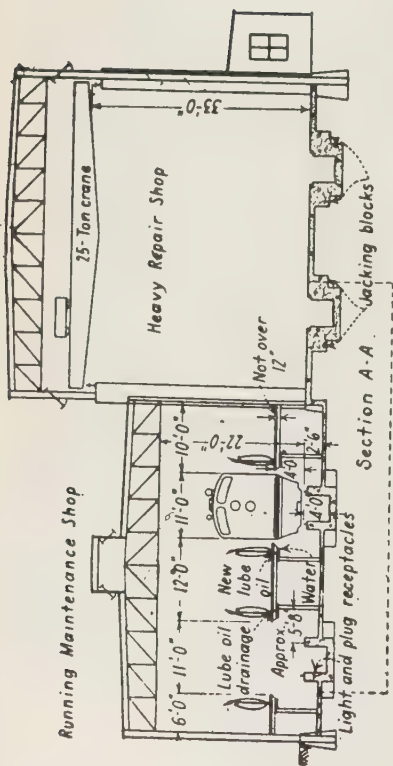


Fig. 8.

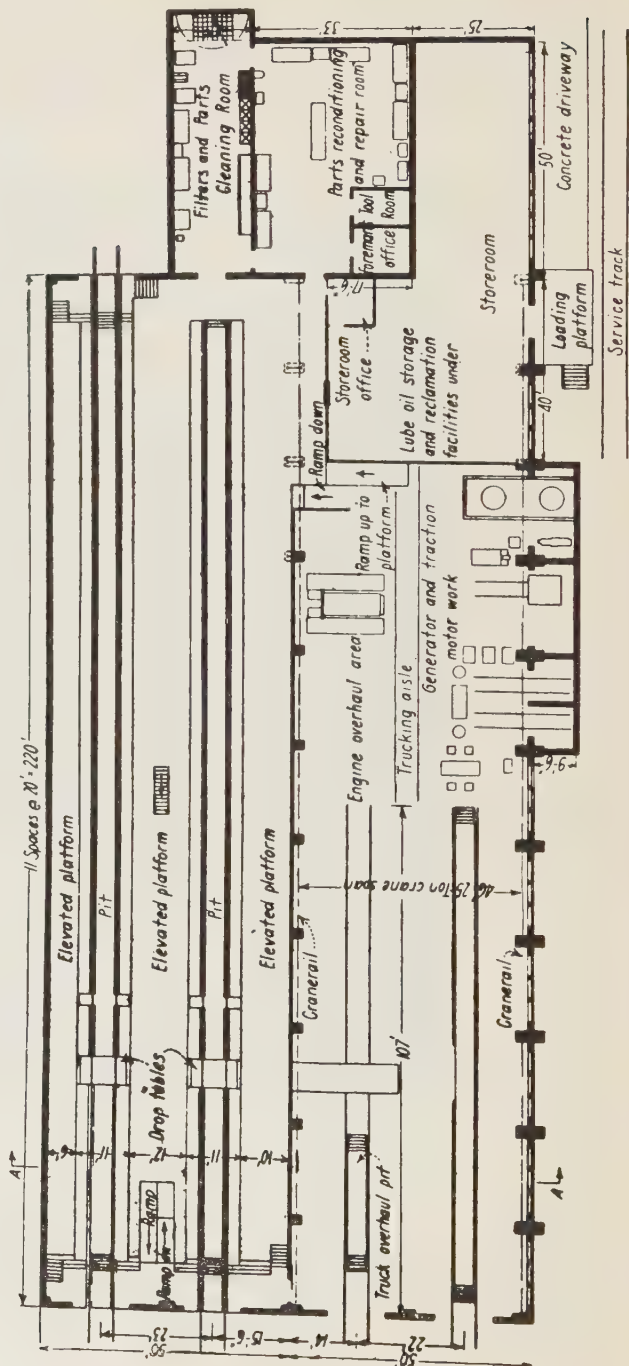


Fig. 9.

parts reconditioning and repair-room, tool-room, store room and office.

At the depressed floor level there is an oil reclamation room and further parts storage.

Special care is given to heating, ventilation and lighting of the whole building.

Supply pipes for fuel, lubricating oil and cooling water, as well as a pipe for oil drainage, along the platforms form also basic requirements of the running maintenance shop.

ling crane, which is used for all heavy lifting operations required, including the replacement of complete Diesel-motors and generator assemblies and the handling of entire three-axled motor trucks.

The further outfitting of this part of the shop is largely dependent on the extent of work done by the Railway itself. There is a growing tendency to send complete Diesel-motors, generators, and traction-motors for repairs to the manufacturers, thus reducing repair-work in the shop to cylinder-

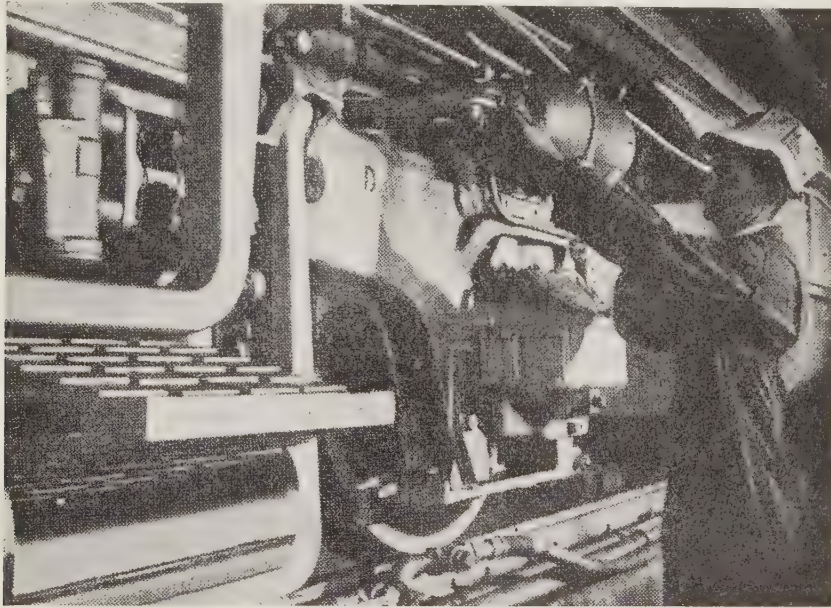


Fig. 10.

Heavy repairshop.

In this part of the building, where only separate units needing heavy repairs or single trucks are taken in, there is neither need for long tracks nor for depressed floors or elevated platforms.

A small pit for truck overhauling and a longer pit for single units are sufficient (Fig. 8). The area is served throughout its full length by a 30-ton overhead travel-

heads and liners, pistons and wrist pin bushings, fuelpumps and injectors, and the reconditioning of brushholders, regulators and other small parts.

Special value is laid upon the establishment of modern facilities, improving, the quality of workmanship and the morale of the maintenance personnel, and creating favourable conditions for speeding up maintenance and repair-work.

The increase of mileage between periodic

inspections and the reduction of the time wanted for these inspections, leads to an important limitation of the dimensions of the facilities in comparison with those wanted for the same steam-power.

The newly built *maintenance shop* of the Southern Pacific at Taylor Yard, Los

Angeles, at present responsible for 45 4-unit 6 000 HP Diesel-electric freight locomotives, 6 3-unit 6 000 HP passenger locomotives, 4 1 500 HP branchline locomotives and 42 Diesel-electric yard locomotives of 600 — 1 000 HP, giving a total of 244 units with together about 350 000 HP is only 350 feet long by 140 feet wide.

The combined *running maintenance — and repair-shop* of the Pennsylvania Railroad at Harrisburg, 268 feet long and 200 feet wide, with adjoining building of 102 feet long by 97 feet wide, containing machine shop, cleaning room, store-rooms, laboratory and offices, completed in 1949, main-

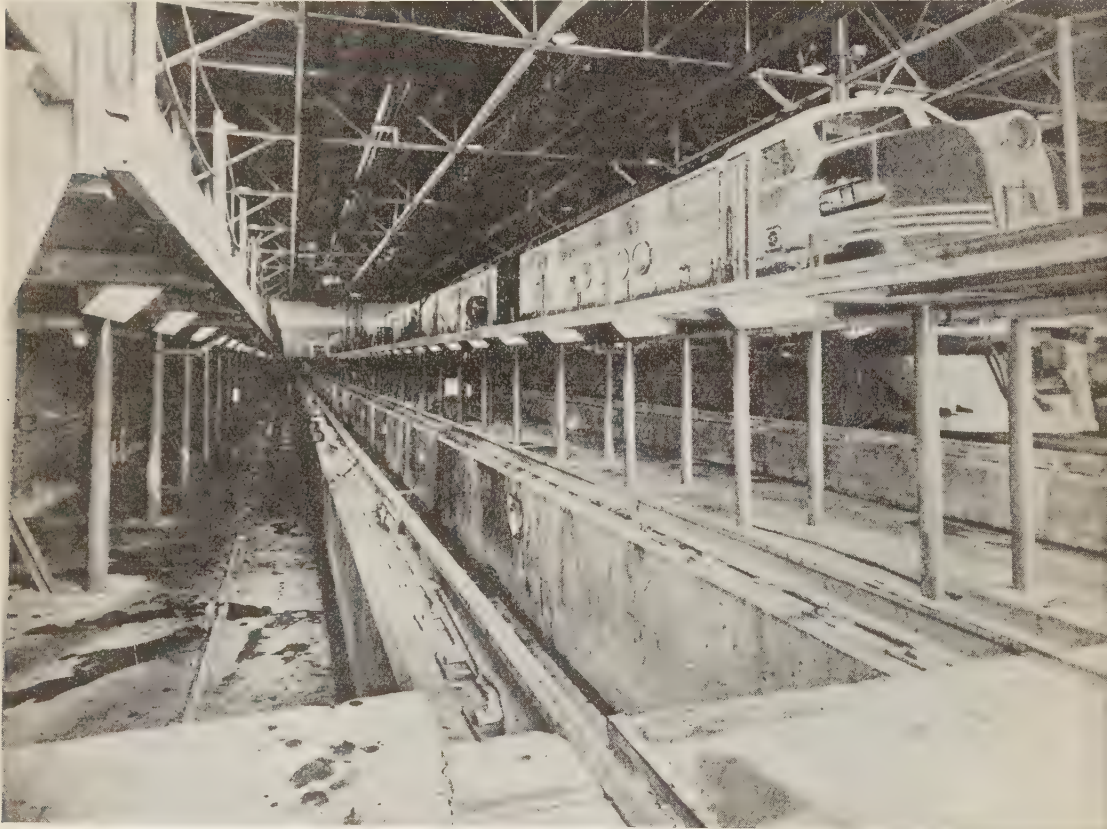


Fig. 11.

Anges, at present responsible for 45 4-unit 6 000 HP Diesel-electric freight locomotives, 6 3-unit 6 000 HP passenger locomotives, 4 1 500 HP branchline locomotives and 42 Diesel-electric yard locomotives of 600 — 1 000 HP, giving a total of 244 units with together about 350 000 HP is only 350 feet long by 140 feet wide.

tains at the moment 65 multiple-unit passenger locomotives, which number will increase gradually.

Fig. 15 gives a bird's-eye view of this modern and simple building, showing a striking difference with the adjoining old steam facilities.

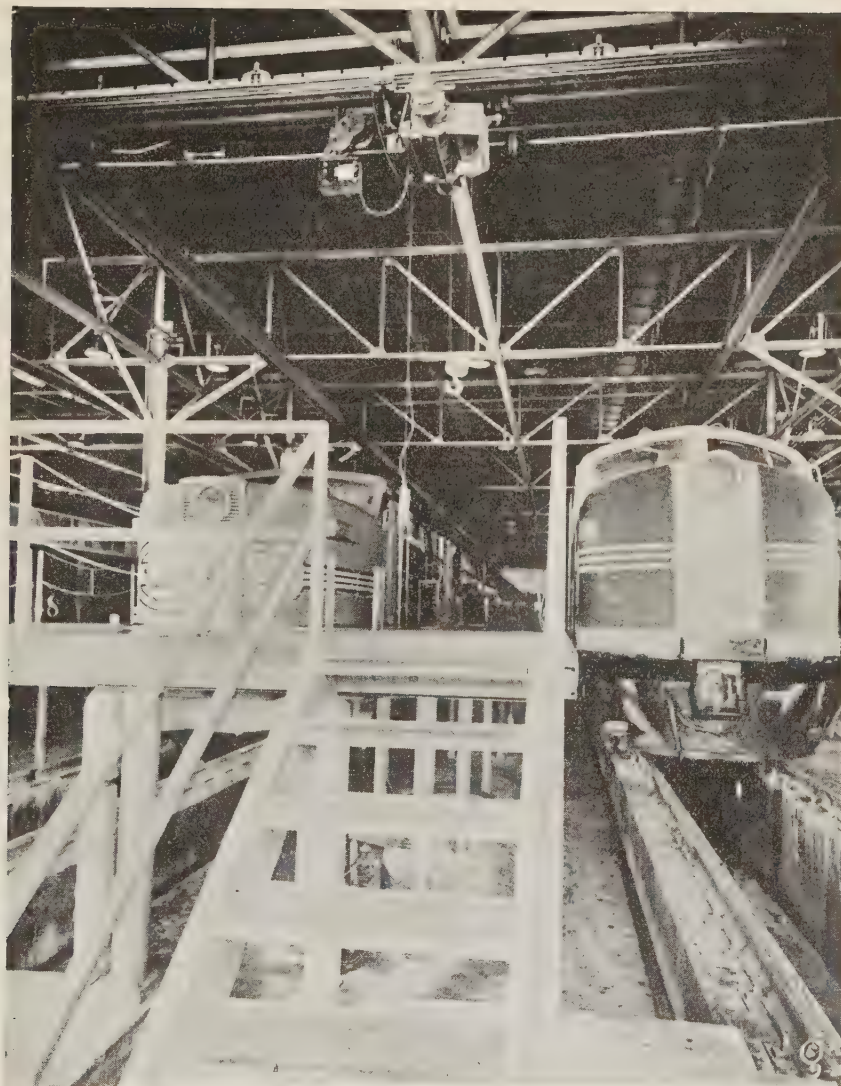


Fig. 12.

Maintenance schemes.

All maintenance work on the road-locomotives is handled on a mileage basis, according to fixed schemes, as advised by the manufacturers.

Mileage inspections largely consist of replacement by unit. Dirty oil and air filters are taken out and replaced by others; parts showing any sign of imperfection are removed and replaced by similar parts taken from the store-rooms.

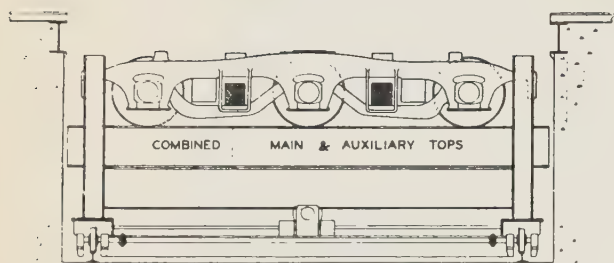


Fig. 13.

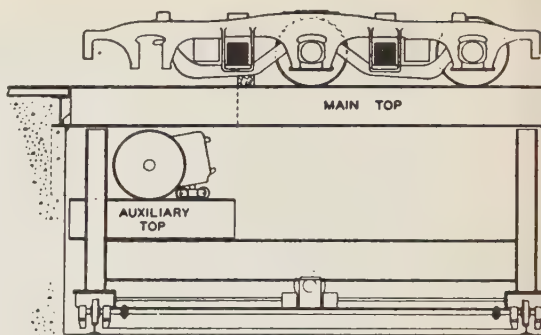


Fig. 14.

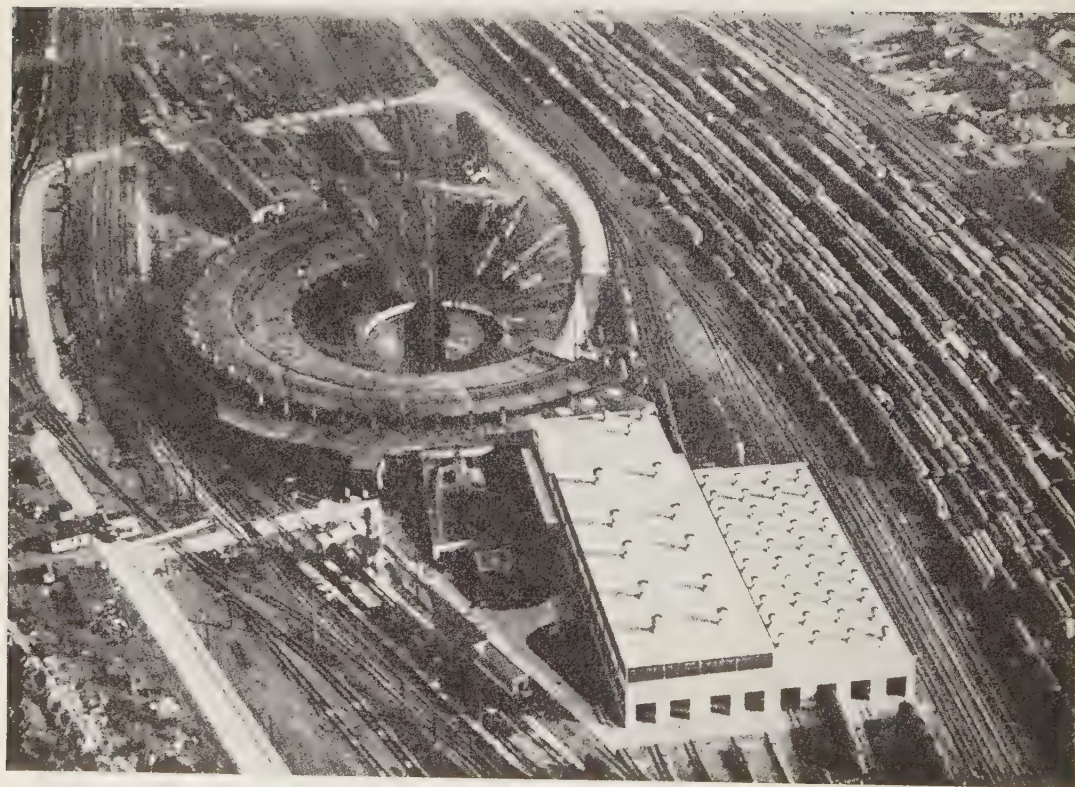


Fig. 15.

When a traction motor needs repairs, the complete truck or the driving axle with motor is taken out with the help of the drop table and replaced by a newly repaired set.

This way of working reduces the shop-

ping time and helps to increase the availability and utilization.

In 1947 mileage inspections in the maintenance shop of the Atchison, Topeka and Santa Fe System at Barstow, Cal. were made in the following sequence :

PASSENGER		FREIGHT	
Kind of inspection	Miles	Kind of inspection	Miles
Trip	up to 4 500	Trip	up to 1 000
4 500-5 000	4 500-5 000	3 500	3 500
9 000-10 000	9 000-10 000	10 000	10 000
monthly	20 000	quarterly	30 000
quarterly	60 000	semi-annual	60 000
semi-annual	120 000	annual	120 000
annual	240 000		

Traction motors on the Pennsylvania Railroad, as well as on the Santa Fe, are replaced after 250 000 miles, whilst general overhauls of the complete locomotive-unit are tentatively set at 1 000 000 miles.

Class repairs for steam-locomotives on the Pennsylvania Railroad in 1948 were carried out after an average mileage of 93 000,

SUMMARY.

Summarizing the previous considerations we may conclude that following advantages of Diesel-electric locomotives versus steam-locomotives in train service are claimed :

a) better thermal efficiency leading, to lower fuel costs;

b) reduction of operating and maintenance costs;

c) higher availability and utilization;

d) much longer runs without engine change;

e) higher mileage;

f) important reduction of servicing, maintenance and repair facilities.

Apart from this we may further mention :

1. less susceptible for weather influences;
2. less influence on the track;
3. faster acceleration at lower speeds;
4. cleaner operation.

OFFICIAL INFORMATION

ISSUED BY THE

PERMANENT COMMISSION

OF THE

International Railway Congress Association.

Rules and Regulations of the Association and List of Countries
to which they apply.

When publishing, in the *Bulletin* for January 1948, the text of the Rules and Regulations of the Association, adopted at the Plenary Session of the Congress, held in Lucern on 27th June, 1947, certain printing errors occurred which resulted in omissions being made in the *List of Countries included in the Association*, appearing in the *Appendix* to these Rules and Regulations.

By virtue of Article 4 of the Rules and Regulations, any modification to the List

of Countries in question requires a written vote by the Permanent Commission. As no such vote has been taken by the Association since it resumed its activities in 1946, obviously, no modification whatever has been made to the said List of Countries.

We therefore deem it advisable, on the eve of the Rome Congress, to reproduce, for the guidance of our readers, the text of the Rules and Regulations together with its *corrected* Appendix.

Rules and Regulations of the International Railway Congress Association.

DECEMBER 1947.

Objects, headquarters and constitution of the Association.

ARTICLE 1. — The object of the International Railway Congress Association is to facilitate the progress and development of railways by the holding of periodical Congresses and by means of publications.

The headquarters of the Association are at Brussels.

ART. 2. — The Association is composed of State Railway Administrations, and of Administrations directly concerned with the working of railways of public utility in countries which have joined the Association.

It is composed of the Railway Administrations included in the list which has been published in the *Bulletin of the Railway Congress* for September 1922, p. 1274.

The Governments of the countries to which the Association extends may also join the Association.

The list of these countries (see appendix) may be altered by a decision of the Permanent Commission, as stated in article 4.

International Organisations which deal essentially with railway operation may be admitted as adherents of the Association, as may also National Unions formed of administrations operating at least 5 000 kilometres (3 107 miles) of railways not belonging to the Association.

Permanent Commission.

ART. 3. — The Association acts through a Permanent Commission composed of members nominated according to article 6.

ART. 4. — The Permanent Commission can, by a postal vote, giving a majority of three

quarters of the total membership, alter the list of countries belonging to the Association.

It has power to arrange for the admission of Organisations in a position to belong to the Association and of Railway Administrations, subject to a written report prepared by a member nominated in each case by the President.

The only Railway Administrations who may be admitted to the Association, beyond those who constituted it in 1922, are those whose principal business is the running of railways worked by mechanical traction, whether owned or leased by a public authority, open for public traffic and having a length of at least 100 kilometres (62 miles) open for traffic and average receipts per annum, over the last three years of at least two million gold francs ⁽¹⁾.

Administrations cease to belong to the Association if they fall within either of the following categories :

a) Undertakings which enter into liquidation or default and Railway Administrations which cease to operate their lines directly in the public service;

b) Members who have not paid their subscriptions for more than two years and who, having been duly notified, have not paid the arrears;

c) Railway Administrations admitted subsequently to the formation of the Association in 1922, which no longer fulfil the conditions laid down in the 3rd paragraph of this article.

⁽¹⁾ In calculating the length of line, sections of mountain railway worked by special methods of haulage are taken as equivalent to twice their length.

The admission of an Administration in a State which itself is only provisionally included in the Association, under the terms of the 1st paragraph of this article, remains provisional until the admission of the State itself is confirmed.

ART. 5. — The Commission shall organise the Congress meetings, prepare an agenda for discussion, be responsible for their preliminary treatment, edit and publish reports for the discussions, draw up a balance sheet, fix, subject to article 17, the amount of the annual subscriptions, be responsible for the finances, and set on foot any investigations and issue any reports or other publications which will, in its judgment, further the objects of the Association.

ART. 6. — The Permanent Commission shall be composed of ex-presidents of the sessions of the Congress, ex-officio members, and elected members, the number of which shall be fixed by each Congress.

The elected members shall be, as far as possible, chosen to represent the different Nations. Under no circumstances shall any one Nation have more than nine elected members.

One third shall retire at each Congress and shall be eligible for re-election.

Members who have ceased to hold office of any kind, so that they are no longer attached to the railway service of an adherent Government, to an adherent Organisation or to a participating Administration which qualified them at the time of their election, shall cease to be members of the Permanent Commission. It shall be the duty of such a member at once to inform the president when he retires. The Permanent Commission may, upon the application of five members, with the consent of the majority of all its members consulted by letter, ask him to remain until the next Congress.

The Commission shall always have the power to complete its number by co-opting delegates of the participating Administrations and adherent Governments. In this case a final election shall be made at the following Congress.

When the place of meeting of a Congress has been fixed, the Permanent Commission shall have power to co-opt as temporary members representatives of the country in which the Congress is to be held.

ART. 7. — The Permanent Commission shall elect from among its members a president and two vice-presidents at its first meeting after each Congress of the Association.

The president and one of the vice-presidents shall be chosen from the Belgian members.

The Commission shall appoint a general secretary, a secretary-treasurer and secretaries. As such they shall have the right to attend the meetings in a consultative capacity.

The Commission shall be summoned by the President when the business of the Association requires it, but in any case at least once a year.

A meeting may be held when demanded by any five members.

Questions shall be decided by the votes of the majority of members present. If the votes are equal, the Chairman shall have the casting vote.

Minutes shall be kept of the proceedings of the Commission. Nine members shall form a quorum.

If at a first meeting this number is not present, the meeting shall be adjourned for not longer than one month, when it shall then be considered valid whatever may be the number of members present.

ART. 8. — The Association shall be represented in Courts of Justice and in all civil actions by the president, or in the event of his being unable to attend, by the general secretary of the Permanent Commission.

Executive Committee.

ART. 9. — At its first meeting after a Congress the Permanent Commission shall nominate three of its members, who, with the president and the vice-presidents of the Commission, shall form an Executive Committee.

The president of the Permanent Commission shall also be president of the Executive Committee.

The general secretary, the secretary-treasurer and the secretaries of the Commission shall be members of the Committee, and shall have the right to take part in discussions, but not to vote.

The members of the Executive Committee shall hold office for a period equal to the interval between two Congresses. They shall be eligible for re-election.

The Executive Committee shall meet at the instigation of the president on his own authority or at the request of three members.

The Committee shall be responsible for the management of current affairs and for financial business, also for superintending and managing investigations, reports and publications; for the editing of the *Bulletin* and for the care of the library and archives. It shall decide as to printing in whole or in part the reports and other documents submitted to a Congress, the circulation of which it regards as necessary to facilitate the discussions. It shall be the duty of the Committee to furnish members of the Association with such special information as they may require.

The Committee shall have the right to appoint and to dismiss the staff.

The carrying out of the decisions of the Committee is entrusted to the president and the general secretary.

Congresses.

ART. 10. — At each Congress the Association shall fix the time and place for the following Congress.

The Permanent Commission may alter such arrangements under exceptional circumstances.

ART. 11. — The following shall have a right to attend the meetings :

1) The members of the Permanent Commission, the secretaries and the secretary-treasurer;

2) Delegates appointed by the participating administrations and adherent Governments and Organisations.

These must belong to the regular and permanent staff of the delegating Administration;

3) The secretaries of sections, and the reporters appointed by the Permanent Commission or by the Executive Committee to report on the items on the agenda.

ART. 12. — The participating Railway Administrations shall be entitled to nominate a number of delegates in proportion to the mileage of their system in the following ratio :

One delegate for lines of not more than 200 km. (124 miles);

Two delegates for lines of 200 to 500 km. (124 to 311 miles);

One additional delegate for each additional 500 km. (311 miles) or fraction thereof above 500 up to 3 000 km. (1 864 miles);

One additional delegate for each additional 1 000 km. (621 miles) or fraction thereof above 3 000 up to 6 000 km. (1 864 up to 3 728 miles);

One additional delegate per 2 000 km. (1 242 miles) or fraction thereof above 6 000 up to 10 000 km. (3 728 up to 6 214 miles);

One additional delegate per 4 000 km. (2 485 miles) or fraction thereof above 10 000 km. (6 214 miles).

The adherent Governments and Organisations may nominate delegates to a maximum number of 10 in the proportion of one delegate for each 100 gold francs subscription up to 500 gold francs, and one additional delegate for each 250 gold francs over 500 gold francs.

The maximum figures quoted above do not include those members who take part in the Congresses in accordance with the 1st and 3rd paragraphs of article 11, and whom the participating Administrations, or adherent Governments and Organisations include amongst their delegates.

All delegates participate in the Congresses with equal rights.

ART. 13. — At the opening of each Congress the officers of the Permanent Commission shall hold office temporarily, and the Congress immediately elect its own officers as follows :

- 1) One or more honorary presidents and vice-presidents;
- 2) One president;
- 3) One or more general secretaries and one or more assistant secretaries.

The presidents of sections, elected as explained in article 14 following, shall also be included.

The delegate nominated first by each government shall be an ex-officio vice-president.

All officers shall be appointed for the duration of the Session.

The election shall take place according to the rules laid down in article 16, paragraph 6. The duties of the officers shall be those laid down by standing orders adopted by deliberative assemblies for the conduct of their proceedings.

After the appointment of the officers, the Congress shall resolve itself into sections, according to the arrangements of items on the agenda submitted by the Permanent Commission.

A member may enter his name for more than one section.

The Congress may also appoint special committees to investigate certain questions.

ART. 14. — Each section or committee shall appoint its own officers consisting of :

- 1) A president;
- 2) One or more vice-presidents;
- 3) One or more principal secretaries and secretaries.

The principal secretaries of each section or committee, however, shall be nominated by the Permanent Commission.

The sections and the special committees shall cease with the termination of each session.

ART. 15. — The discussions of the Congress shall be confined to the questions set down in the agenda for the session by the Perma-

nent Commission. The latter may receive suggestions, either as regards the inclusion of a question or relating to a particular question already raised by participants or adherents.

A reporter appointed by the Permanent Commission, shall prepare a brief outline of each question placed on the agenda, together with a resumé of the documents he has been furnished with; he will not draw up the final summary.

No question shall be discussed at a general meeting without having been first considered by a section or special committee.

ART. 16. — The discussions shall be conducted in French and in the language of the country in which the Congress is held. Speeches in any other language shall be translated into French.

The minutes and reports shall be drawn up in French, but speakers on demand shall be entitled to have their original words reproduced.

The officials of the respective sections shall draw up an abstract of the discussions setting forth the various opinions expressed in the section. After receiving the approval of the section these abstracts shall be submitted to the general meeting. They shall then be inserted in the minutes after having been completed by the addition, if necessary, of any new opinions expressed at the general meeting itself.

The Congress shall not vote except on questions of management or organisation.

On these special questions, the votes of the majority of the members present shall be taken by members rising in their places. If there is any doubt the votes shall be counted. A roll call shall not be held except at the request of not less than twelve members.

Subscriptions and auditing of accounts.

ART. 17. — The expenses of the Congresses, of the Permanent Commission and of the Executive Committee shall be covered by :

- 1) The annual subscription of members;

2) Subsidies and other casual receipts.

The annual subscription shall consist of :

a) In the case of adherent Governments and Organisations, such an amount as they may decide, but which in the case of member Organisations shall not be less than 200 gold francs;

b) For the member Administrations, a fixed sum of 200 gold francs plus a sum proportionate to the length of the system. This variable sum is fixed by the Permanent Commission, but may not exceed *the third* of a gold franc per kilometre.

The financial year shall begin on the 1st January.

ART. 18. — Payment of the subscriptions entitles participating Administrations, Governments and adherent Organisations to receive free as many copies of reports, of the proceedings and other publications as the number of their delegates.

ART. 19. — The Permanent Commission shall present to each Congress a report on the financial position. The Congress shall appoint two auditors to pass the accounts.

Revision of the constitution, dissolution and liquidation.

ART. 20. — The rules may be revised by the Congress on the proposal of the Permanent Commission, due notice being given to the participants and adherents by a letter sent out at least two months before the opening of the session.

Proposals for modifications put forward by participants or adherents must reach the Permanent Commission at least six months before the opening of the session. If they are adopted by the Commission, they are submitted to the Congress by means of a report sent out by the Commission, which should be despatched to the participants and adherents at least two months before the opening of the session.

If the Permanent Commission does not accept a proposed modification, it shall not

be submitted to the Congress, unless it is supported in writing by participating Administrations or adherent Governments or Organisations entitled to be represented by 100 delegates at the Congress. In this case the proposition is submitted to the participants and adherents by a letter from the Permanent Commission sent out at least two months before the opening of the session.

ART. 21. — Every proposal for amending the rules shall be discussed by the Congress on a report of a special committee presided over by the President of the Permanent Commission, or by his delegate and composed of eleven members, as follows :

a) The President of the Permanent Commission or his delegate;

b) Four members delegated by the Permanent Commission;

c) One delegate from each of the five sections which form the Congress, this delegate being chosen after discussion of the suggestion by the section;

d) One delegate representing the authors of the suggestion.

ART. 22. — The proposed modification shall only be considered if it is supported by the clear majority of the delegates present at the general meeting.

The modification shall not be finally adopted until a written ballot has been taken, which shall be called for by a circular letter sent out by the Permanent Commission during the month following the termination of the session of the Congress. In this ballot each Administration, Government or Organisation belonging to the Association shall have a number of votes equal to the number of the delegates to which it is entitled.

The ballot shall be closed six months after the termination of the session of the Congress.

Only those modifications will be adopted which are supported by two-thirds of the votes received at headquarters of the Permanent Commission by the end of this period.

The results of the ballot will be published in the monthly *Bulletin* of the Association.

ART. 23. — Adherent Governments and Organisations, also participating Administrations constituting the Association pledge themselves to promote the meetings of the Congress and the work of the Permanent Commission.

ART. 24. — The Association may be dissolved only by a three quarters majority, on a postal vote from the participating Administrations, each one having a number of votes equal to that of the delegates to which it is entitled.

ART. 25. — In the event of dissolution, the Permanent Commission shall have authority to arrange the liquidation.

The assets of the Association are to be distributed by its agency among works conforming with the objects of the Association or among philanthropic works in connection with railways.

ART. 26. — In no circumstances shall participating Administrations and adherent Governments and Organisations who for any reason have ceased to belong to the Association, have any claim on the assets of the Association.

APPENDIX.

LIST OF COUNTRIES

included in the International Railway Congress Association.

Argentina;
Austria;
Belgium and Colony;
Bolivia;
Brazil;
Bulgaria;
Chili;
China;
Colombia;
Costa Rica;
Cuba;
Czechoslovakia;
Denmark;
Dominica;
Ecuador;
Egypt;
Finland;

France, Algeria, Tunisia,
Colonies and Protectorates;
Germany;
Great Britain and North of
Ireland, Dominions, Protectorates and Colonies;
Greece;
Haiti;
Hungary;
India;
Irish Free State;
Italy;
Japan;
Yugoslavia;
Luxemburg;
Mexico;

Netherlands and Colonies;
Nicaragua;
Norway;
Paraguay;
Peru;
Poland;
Portugal and Colonies;
Rumania;
Salvador;
Siam;
Spain;
Sweden;
Switzerland;
Turkey;
United States of America;
Uruguay.

MONTHLY BIBLIOGRAPHY OF RAILWAYS⁽¹⁾

PUBLISHED UNDER THE SUPERVISION OF

P. GHILAIN,

General Secretary of the Permanent Commission of the International Railway Congress Association.

(JANUARY 1950)

[016. 385. (02)

I. — BOOKS.

In French.

1949 69 (02)
FROMENT (G.).

Procédés généraux de construction.

Paris, Eyrolles, éditeur. Collection de l'Ingénieur des Travaux publics et du Bâtiment, 2 volumes (16 × 24 cm) de 490 et 314 pages, avec 285 et 277 figures. (Prix : 2 300 et 4 600 fr. fr.)

1949 621 .83
HENRIOT (G.) & SCHWEICH (R.).

Traité théorique et pratique des engrenages. Tome I : Théorie et technologie.

Paris, Dunod, éditeur. 1 volume (16 × 25 cm) de VIII-350 pages avec 306 figures et 4 dépliant. (Prix : relié, 1 950 fr. fr.)

1949 385 (08 (493)
OFFICE D'EXPLOITATION DES TRANSPORTS COLONIAUX (OTRACO).

Rapport 1948.

Bruxelles, OTRACO, 101, avenue Louise. 1 brochure (22.5 × 29.5 cm) de 70 pages, avec tableaux, graphiques, cartes et photos hors-texte.

1949 313 .385
Statistique internationale des Chemins de fer. Année 1947.

Paris, Union Internationale des Chemins de fer, 10, rue de Prony. 1 volume (24 × 32 cm) de 164 pages. (Prix : 1 200 fr. fr.)

1949 62 (01)
TIMOSHENKO (S.).

Résistance des matériaux. Tome II. Traduit de l'anglais sur la 2^e édition par Ch. LAFFITTE.

Paris et Liège, Librairie Ch. Béranger, éditeur. 1 volume (16 × 24 cm) de 480 pages avec 309 figures. (Prix : 2 800 fr. fr.)

In German.

1948 625 .13
WIEDEMANN (K.).

Neuere Anwendung der Unterfangungsbauweise im Tunnel- und Stollenbau. 3 Auflage.

Berlin, Verlag W. Ernst und Sohn. 58 Seiten. (Preis : D. M. 4.20.)

In English.

1949 621 .132 .1 (42)
ALDRICH (L.).

Great Eastern locomotives. Past and present. 1862-1948. Fifth edition.

Published by the Author at 15, Queen Street, Bright-hingsea. Essex. (9 × 5 3/4 in.) 122 pages. Illustrated. (Price : 10 s. 6 d.)

1949 656 .222 .1
ALLEN (C. J.).

Locomotive practice and performance in the Twentieth Century.

Cambridge : W. Heffer & Sons Ltd. 302 pages. Cloth covers. (Price : 21 s.)

1949 625
DISNEY (Ch.) & LEGGET (R. F.).

Modern Railroad Structures.

London : Mc. Graw Hill Publishing Company Ltd. Aldwych House, W. C. 2. (Price : 24 s.)

1949 693
Fire Protection and Accident Prevention Year Book, 1950.

Edited by Geoffrey F. D. PRATT.

London : Benn Brothers Limited, Bouverie House, Fleet Street, E. C. 4. (Price : 10 s. 6 d., post free.)

(1) The numbers placed over the title of each book are those of the decimal classification proposed by the Railway Congress conjointly with the Office Bibliographique International, of Brussels. (See « Bibliographical Decimal Classification as applied to Railway Science », by L. WEISSENBRUCH, in the number for November 1897, of the *Bulletin of the International Railway Congress*, p. 1509.)

1949 621 .132 .1
HAMILTON ELLIS.
Some classic locomotives.
London : George Allen and Unwin, Ltd., Ruskin
House, 40, Museum Street, W. C. 1. (Price : 21 s. net.)

1949 621 .438
THOMSON (W. R.).
The fundamentals of gas turbine technology.
Power Jets (Research and Development), Ltd. (Price :
25 s.)

1949 621 .43
The Modern Diesel.
Edited by G. Geoffrey Smith, Revised by Donald
H. Smith. Eleventh edition.
London : Iliffe & Sons, Ltd., Dorset House, Stam-
ford Street, S. E. 1. (Price : 7 s. 6 d.)

1949 385 (02
Universal Directory of Railway Officials and Railway
Year Book 1949-1950.
London : The Directory Publishing Company, Ltd.,
33, Tothill Street, Westminster, S. W. 1. (Price : 30 s.)

In Netherlands.

1947 621 .335
BAEYENS (F.).
Het rollend materieel in elektrische tractie.
Brussel, Beroepsvereniging der Ingenieurs van de
Nationale Maatschappij der Belgische Spoorwegen.
Eene brochure (21 × 29.5 cm), 10 bladzijden.

[016. 385. (05)

II. PERIODICALS.

In French.

Annales des Travaux publics de Belgique.
(Bruxelles.)

1949 621 .392 (493) & 624 (493)
Annales des Travaux publics de Belgique, août, p. 395.
DESPRETS (R.). — Note sur les ponts-rails soudés du
réseau de la S. N. C. B. (1 700 mots, fig. & photos hors-
texte.).

1949 721 .1
Annales des Travaux publics de Belgique, août, p. 407.
PADUART (A.). — Calcul des semelles de fondation
de raideur finie reposant sur pieux verticaux et inclinés.
(3 000 mots & fig.)

1949 691
Annales des Travaux publics de Belgique, octobre,
p. 481.
L'HERMITE (R.). — Nouvelles recherches sur le
béton. (8 000 mots & fig.)

1949 62 (01 & 691
Annales des Travaux publics de Belgique, octobre,
p. 513.
SOETE (W.) & VANCROMBRUGGE (R.). — La
résistance à la fatigue ondulée des fils utilisés en béton
précontraint. (2 500 mots, tableaux & fig.)

1949 624 .63 (493) & 691 (493)
Annales des Travaux publics de Belgique, octobre,
p. 565.
MANOUVRIER (F.). — Etude des bétons mis en
oeuvre lors de la construction du pont-route en arcs aus-
dessus de la Dendre et des voies ferrées Bruxelles-Lille
et Leuze-Renaix. (12 000 mots, tableaux & fig.)

Bulletin d'études et de recherches techniques.
(Bucarest.)

1949 691
Bulletin d'études et de recherches techn., n° 1, janvier-
mars, p. 183.
STEOPOE (A.). — Sur la prise des ciments en présence
de grandes quantités d'eau. (1 500 mots & fig.)

1949 691
Bulletin d'études et de recherches techn., n° 1, janvier-
mars, p. 189.
STEOPOE (A.). — Essais sur les bétons au liant de
ciment aux laitiers. (2 500 mots & tableaux.)

Bulletin des Transports internationaux
par Chemins de fer. (Berne.)

1949 385 .63
Bulletin des transp. intern. par ch. de fer, juin, p. 202.
EGER (G.). — Considérations sur la cession de créan-
ces nées du contrat de transport international. (4 000 mots.)

Bulletin de l'Union internationale
des Chemins de fer. (Paris.)

1949 385 (09 (61)
Bulletin de l'Union intern. des ch. de fer, juin, p. 189.
Les Chemins de fer Nord-Africains pendant la guerre
(1939-1945). (12 000 mots, cartes & fig.)

1949 656 .262 (494)
Bulletin de l'Union intern. des ch. de fer, juin, p. 209.
THOMANN (F.). — Les buffets de gare des Chemins
de fer fédéraux suisses. (4 000 mots & fig.)

1949 656 .2 (73)
Bulletin de l'Union intern. des ch. de fer, juin, p. 215.
Les transports ferroviaires aux Etats-Unis. (1 000 mots
& tableaux.)

Economie et Technique des Transports.

(Zurich.)

1949 388 (485)
Economie et Technique des Transports, mai-juin, p. 51;
juillet-août, p. 115.

SAMUELSON (S.). — Réseau Métropolitain de Stockholm. (3 500 mots & fig.)

1949 625 .62 (494)
Economie et Technique des Transports, mai-juin, p. 57.
CHOISY (E. G.). — La modernisation du réseau des
Tramways de Genève. (2 000 mots & fig.)

1949 388 (45)
Economie et Technique des Transports, mai-juin, p. 67;
juillet-août, p. 113.

PATRASSI (A.). — L'augmentation de la capacité
des moyens de transport de la ville de Milan. (3 000 mots
& fig.)

1949 625 .2 : 625 .62
Economie et Technique des Transports, mai-juin, p. 75;
juillet-août, p. 109.

LOERCHER (P.). — Voitures de tramways à 4 ou à 3
essieux ? (2 500 mots, tableaux & fig.)

1949 621 .33 (494)
Economie et Technique des Transports, mai-juin, p. 79.
GAVIN (H.). — L'électrification du Chemin de fer
d'Yverdon à Sainte Croix. (2 000 mots & fig.)

Génie Civil. (Paris.)

1949 385 (44)
Génie Civil, n° 3261, 15 septembre, p. 340.
La situation actuelle des Chemins de fer français. (3 000
mots.)

1949 624 .63 (82)
Génie Civil, n° 3261, 15 septembre, p. 350.
Le viaduc Sarandi, à Buenos-Aires. (1 200 mots & fig.)

1949 621 .335
Génie Civil, n° 3262, 1^{er} octobre, p. 357.
DUMAS (J.). — La locomotive électrique CC à
grande vitesse de la Société Nationale des Chemins de fer
Français. (3 500 mots & fig.)

1949 651
Génie Civil, n° 3262, 1^{er} octobre, p. 369.
La carte Mac Bee Keysort pour le classement des docu-
ments. (1 200 mots & fig.)

1949 625 .13 (44 + 45)
Génie Civil, n° 3263, 15 octobre, p. 385.
Le tunnel routier franco-italien projeté sous le massif
du Mont Blanc. (2 000 mots & fig.)

1949 625 .232 & 669
Génie Civil, n° 3263, 15 octobre, p. 387.
Une nouvelle conception du matériel de Chemins
de fer : les trains surbaissés Talgo. (1 500 mots & fig.)

Notre Métier. (Paris.)

1949 656 .212 .7 (44)
Notre Métier, 11 juillet, p. 3.
FORCE (G.). — La halle mécanisée d'Angers-St-Laud
clé de voûte du transport accéléré des marchandises.
(1 500 mots & fig.)

1949 625 .232 (73) & 669 (73)
Notre Métier, 18 juillet, p. 5.
STEAD (A. L.). — « Talgo » Train du mystère. (3 000
mots & fig.)

1949 625 .113 (44) & 625 .13 (44)
Notre Métier, 25 juillet, p. 2.
JOYEUX. — La rampe et le tunnel de Blaisy. (2 500
mots & fig.)

1949 385 (09 .2)
Notre Métier, 5 septembre, p. 3.
Un grand ingénieur : I. K. Brunel. (1 500 mots & fig.)

1949 621 .332 (44)
Notre Métier, 5 septembre, p. 6.
FORCE (G.). — Un chantier caténaire entre Les
Laumes et Dijon. (2 000 mots & fig.)

1949 385 (07 .13 (44)
Notre Métier, 19 septembre, p. 8.
Dix ans d'existence de l'Ecole du S. E. S. de St-Ouen,
Région du Nord, S. N. C. F. (1 500 mots & fig.)

Rail et Route. (Paris.)

1949 385 (01 (61) & 385 (09 (61)
Rail et Route, mai, p. 5.
Le Méditerranée-Niger. (5 000 mots & fig.)

1949 625 .2 (44)
Rail et Route, juillet p. 4; août, p. 4; septembre, p. 4.
ROMESTAIN. — Marques et signes utilisés sur les
voitures et les wagons de la S. N. C. F. (3 000 mots & fig.)

1949 621 .132 .3 (54)
Rail et Route, juillet, p. 10.
Nouvelles locomotives Mikado classe XD pour les
Indes. (400 mots & fig.)

1949 656 (44)
Rail et Route, août, p. 13.
Coordination des transports par rail et par route.
(2 000 mots.)

Revue de l'Aluminium. (Paris.)

1949 62 (01 & 669
Revue de l'Aluminium, septembre, p. 278.
BOCCON-GIBOD (R.). — L'endurance des métaux
légers. (4 000 mots & fig.)

1949 625 .617 (44) & 669 .71 (44)
Revue de l'Aluminium, octobre, p. 346.
Les voitures allégées à grande capacité des Chemins
de fer de la Camargue. (700 mots & fig.)

Revue Générale des Chemins de fer. (Paris.)

1949 625 .232 (44)
Revue générale des Chemins de fer, août, p. 337.
CIANCIA-AILIS. — La construction en acier doux soudé d'une rame sur pneumatiques. (2 000 mots & fig.)

1949 656 .211 (44) & 656 .212 (44)
Revue générale des Chemins de fer, août, p. 342.
GERBER. — La transformation des gares de Dijon et de Perrigny. (8 000 mots & fig.)

1949 656 .212 .6 (44)
Revue générale des Chemins de fer, août, p. 358.
ROUSSE (P.). — La manutention mécanique dans les grands centres à régime accéléré. (2 000 mots & fig.)

1949 625 .245 (44)
Revue générale des Chemins de fer, août, p. 364.
Un wagon très allégé à grande capacité et à déchargement automatique. (600 mots & fig.)

1949 625 .2 (44) & 625 .28 (44)
Revue générale des Chemins de fer, août, p. 367.
Idées actuelles de la S. N. C. F. en matière de traction et de matériel roulant. (4 000 mots.)

1949 625 .42 (45)
Revue générale des Chemins de fer, août, p. 371.
Le Métropolitain de Rome. (1 200 mots & fig.)

1949 656 .23 (45)
Revue générale des Chemins de fer, août, p. 376.
La nouvelle tarification des Chemins de fer italiens de l'Etat. (2 500 mots & tableaux.)

Science et Technique. (Bruxelles.)

1948 656 .13 (493)
Science et Technique, nos 1-2, p. 13.
MEULEMANS (G.). — La ventilation du tunnel de la Jonction Nord-Midi. (2 400 mots & fig.)

1948 621 .13
Science et Technique, nos 1-2, p. 17.
LAMALLE (U.). — La locomotive pour trains rapides de voyageurs. D'où vient-elle? Où va-t-elle? (2 400 mots, tableaux & fig.)

1949 625 .212 (44)
Science et Technique, nos 1-2, p. 3.
LAMALLE (U.). — Le train sur pneumatiques Paris-Strasbourg de la S. N. C. F. (2 500 mots & fig.)

In German.

Internationales Archiv für Verkehrswesen.
(Mainz.)

1949 656 .1 (43)
Internationales Archiv für Verkehrswesen, Nr 6, Erstes Augustheft, S. 121.
PLATZMANN. — Ordnung des Strassenverkehrs-
wesens in Deutschland. (5 000 Wörter.)

1949 621 .33 (43)
Internationales Archiv für Verkehrswesen, Nr 7, Zweites Augustheft, S. 148.
VIERFUSS (H.). — Die wirtschaftliche und soziale Bedeutung des elektrischen Zugbetriebes im Rhein-Ruhrgebiet. (4 500 Wörter, Tabellen & Abb.)

1949 656
Internationales Archiv für Verkehrswesen, Nr 8, 1tes Septemberheft, S. 172.
BRANDT. — Das Verkehrswesen in der Wandlung. (2 000 Wörter.)

1949 388
Internationales Archiv für Verkehrswesen, Nr 8, 1tes Septemberheft, S. 174.
PLATZMANN. — Entwicklung und Zukunft der Stadtschnellbahnen. (6 000 Wörter.)

1949 388 (4)
Internationales Archiv für Verkehrswesen, Nr 10-11, Oktoberheft, S. 224.
HUG (Ad.-M.). — Verkehrsprobleme in Grosstädten Europas. (2 500 Wörter & Abb.)

1949 656 .2 (4 + 73)
Internationales Archiv für Verkehrswesen, Nr 12, 1tes Novemberheft, S. 249.
HOMBERGER (L.-M.). — Grundlagen des Eisenbahnbetriebes und Verkehrs in Europa und in den Vereinigten Staaten von Amerika. (4 500 Wörter.)

1949 656 (492)
Internationales Archiv für Verkehrswesen, Nr 12, 1tes Novemberheft, S. 253.
REITSMA (S.-A.). — Die Niederländischen Eisenbahnen und der Strassenverkehr. (6 000 Wörter & Karte.)

Schweizerisches Archiv für Verkehrswissenschaft
und Verkehrspolitik. (Zürich.)

1949 385 (485)
Schweiz. Archiv für Verkehrswissenschaft u. Verkehrspolitik, Nr 3, S. 185.
PASZKOWSKI (F.). — Die Eisenbahnpolitik Schwedens. (18 000 Wörter, Tabellen & Karte.)

1949 656 .234
Schweiz. Archiv für Verkehrswissenschaft u. Verkehrspolitik, Nr 3, S. 223.
FLAMMER (A.). — Fahrpreismässigungen für die Familie. (10 000 Wörter & Tabellen.)

1949 313 : 656 (494)
Schweiz. Archiv für Verkehrswissenschaft u. Verkehrspolitik, Nr 3, S. 248.
FREY (L.). — Der Stand der Schweizerischen Verkehrsstistik. (8 000 Wörter.)

In English.

Bulletin

American Railway Engineering Association.
(Chicago.)

1949 62 (01)

Bulletin American Railway Engineering Association,
September-October, p. 51.WYLY (L. T.), SCOTT (M. B.), Mc. CAMMON
(L. B.) and LINDNER (C. W.). — **A study of the beha-
vior of floorbeam hangers.** (23 pages with fig.)

1949 698

Bulletin American Railway Engineering Association,
September-October, p. 87.FRYE (C. S.) and DIEHLMAN (G.). — **A study
of shop coat structural steel paint primer.** (16 pages with
tables and fig.)

The Engineer (London.)

1949 656 .25 (42)

The Engineer, May 13, p. 518; May 20, p. 546; May 27,
p. 575; June 3, p. 602.NOCK (O. S.). — **Railway signalling developments,
1923-1948 (to be continued).** (12 000 words & fig.)

1949 625 .431 .72 (42)

The Engineer, May 13, p. 535.

Stephenson Crossley Diesel shunting locomotive. (1 300
words & fig.)

1949 621 .431 .72 (73)

The Engineer, June 10, p. 644.

The « A. F. C. Talgo » train. (1 000 words & fig.)

1949 621 .431 .72 (42)

The Engineer, June 10, p. 645.

Long non-stop run of Diesel-electric locomotive No.
10000/1. (600 words & fig.)

1949 656 .28 (0 (42)

The Engineer, July 1, p. 20.

Accidents on Railways, 1948. (200 words.)

Engineering. (London.)

1949 625 .245 (42)

Engineering, No. 4336, March 4, p. 200.

Rolling stock for transporting stators of turbo-alter-
nators. (600 words & fig.)

1949 625 .231 (42)

Engineering, No. 4336, March 4, p. 210.

Double-deck railway carriage. (400 words & fig.)

Journal of the Institution
of Civil Engineers. (London.)

1949 625 .13 (944)

Journal of the Institution of Civil Engineers, October,
p. 419.FEWTRELL (A. C.). — **The new Hawkesbury river
railway bridge,** New South Wales, Australia. (28 pages
with fig.)The Journal of the Institute of Transport.
(London.)

1949 385 .3 (42)

The Journal of the Institute of Transport, September,
p. 168.JENKINS (G.). — **The relations between the Ministry
of Transport and the British Transport Commission.** (2 400
words.)

1949 691 & 721 .9

The Journal of the Institute of Transport, November,
p. 19.ARMSTRONG (W. E. I.). — **Bond in pre-stressed
concrete.** (8 000 words & fig.)

The Locomotive. (London.)

1949 621 .132 .3 (42) & 621 .134 .2 (42)

The Locomotive, October 15, p. 146.

Infinitely variable poppet valve gear. (1 600 words
& fig.)

1949 621 .335 (42)

The Locomotive, October 15, p. 148.

Electric locomotive No. 20003, Southern Region.
(2 200 words & fig.)

1949 621 .132 .1 (42)

The Locomotive, October, 15, p. 153.

ROUNTHWAITE (J. M.). — **N. E. R. class « R »
locomotives.** (1 800 words, tables & fig.)

1949 621 .132 .1 (42)

The Locomotive, November 15, p. 162.

« Leader » class, Southern Region. (600 words & fig.)

Modern Transport. (London.)

1949 625 .232 (42)

Modern Transport, July 30, p. 15; November 19, p. 5.

Modern railway carriages 5. — **Edwardian dining cars.**
6. — **The Belle and the Maid (to be continued).** (3 100
words & fig.)

1949 656 .1 (42) & 656 .23 (42)

Modern Transport, August 6, p. 3.

Potentialities of road and rail. (1 200 words.)

1949 656

Modern Transport, August, 20, p. 3.

THOMAS (R.). — **Charging for public transport.**
Need for assessment of rail and road costs. (1 500 words.)

1949 621 .33 (494)
Modern Transport, August 20, p. 8.
Modernisation of a Swiss local railway. (400 words & fig.)

1949 621 .431 .72 (42) & 625 .285 (42)
Modern Transport, August 20, p. 17; October 8, p. 19.
Railway oil engines. (3 200 words, tables & fig.)

Railway Age (New York.)

1949 621 .438 (73)
Railway Age, July 2, p. 18.
EGBERT (P. T.) and WILSON (G. W.). — Gas-turbine electric locomotive ready for service. (2 600 words & fig.)

1949 621 .431 .72 (73)
Railway Age, July 2, p. 38.
Nickel plate receives first Lima-Hamilton switcher. (2 500 words & fig.)

1949 625 .144 .1 (73)
Railway Age, July 9, p. 92.
Continuous rail for cascade tunnel. (1 200 words & fig.)

1949 656 .212 .5 (73)
Railway Age, July 16, p. 42.
Improvements double speed of big yard. (2 000 words & fig.)

1949 625 .232 (73)
Railway Age, July 16, p. 50.
New cars for the « Shasta Daylights ». (2 100 words & fig.)

1949 625 .172 (73)
Railway Age, July 23, p. 37.
Louisville & Nashville knows its track. (2 100 words & fig.)

1949 625 .172 (73)
Railway Age, July 30, p. 34.
HOWARD (Neal D.). — Mechanized track maintenance. Pennsylvania style. (2 400 words & fig.)

1949 625 .2 (0) (73)
Railway Age, July 30, p. 39.
CARTWRIGHT (K.). — Improving the ride in passenger trains. (1 800 words.)

1949 621 .335 (73)
Railway Age, July 30, p. 42.
FOY (J. C.), GAYNOR (J. F. N.) and GOWANS (F. D.). — Motor-generator type electric locomotives are good performers. (3 000 words & fig.)

1949 621 .431 .72 (73)
Railway Age, July 30, p. 53.
A rolling lab on the high rails. (1 400 words & fig.)

Railway Engineering and Maintenance. (Chicago.)

1949 625 .113 (73)
Railway Engineering and Maintenance, May, p. 482.
KLINGEL (T. R.). — Charts speed determination of proper curve characteristics. (500 words & diag.)

1949 62 (01 & 691)
Railway Engineering and Maintenance, May, p. 492.
FERGUSON (R.). — Corrosion of steel in concrete. (400 words.)

1949 721 .5 (73)
Railway Engineering and Maintenance, June, p. 571.
Reading terminal trainshed gets new roof. (1 400 words & fig.)

1949 625 .172 (73)
Railway Engineering and Maintenance, June, p. 574.
Pennsylvania sweeps track with Diesel-electric machine. (1 200 words & fig.)

1949 625 .143 .4 (73)
Railway Engineering and Maintenance, June, p. 577.
Baffle-box method reduces end-hardening costs. (800 words & fig.)

Railway Gazette. (London.)

1949 625 .17 (42)
Railway Gazette, No. 6, August 5, p. 162.
Strengthening of Braidhurst Viaduct, Scottish Region. (600 words & fig.)

1949 656 .285 (42)
Railway Gazette, No. 6, August 5, p. 165.
Ministry of Transport Accident Report, Stockport, L. M. R., British Railways : Nov. 30, 1948. (1 800 words & diag.)

1949 621 .332 (42)
Railway Gazette, No. 7, August 12, p. 187.
Remote supervisory control for London Transport N. E. extension. (1 400 words & fig.)

1949 621 .338 (494)
Railway Gazette, No. 7, August 12, p. 189.
Railcars for the Berner Oberland Bahn. (400 words & fig.)

1949 313 .385 (42)
Railway Gazette, No. 7, August 12, p. 194.
British Transport Commission. — Summary of the principal statistics for the four-week period ended June 19. (400 words & tables.)

1949 656 .254 (42)
Railway Gazette, No. 8, August 19, p. 213.
Re-signalling at Lime street station Liverpool. (1 500 words & fig.)

1949 656 .1 (489) & 656 .2 (489)
Railway Gazette, No. 8, August 19, p. 222.
Reorganisation of local goods traffic in Denmark. (500 words.)

- 1949 621 .132 .7 (42)
 Railway Gazette, No. 9, August 26, p. 243.
 Baguall shunting engines for Western Region. (200 words & fig.)
- 1949 625 .232
 Railway Gazette, No. 9, August 26, p. 244.
 Sleeping cars for the Wagons-Lits Company. (400 words & fig.)

Diesel Railway Traction. (London.)

- 1949 625 .285
 Diesel Railway Traction, November, p. 199.
 KOFFMAN (J. L.). — Lateral control of railcar bogie suspension. (1 200 words & fig.)
- 1949 625 .28 (42)
 Diesel Railway Traction, November, p. 201.
 REED (B.). — The Maybach railway oil engine. (4 600 words & fig.)
- 1949 621 .431 .72
 Diesel Railway Traction, November, p. 211.
 A mobile Diesel testing station. (600 words & fig.)

Railway Mechanical Engineer. (New York.)

- 1948 385 (06 (73) & 621 .3 (73)
 Railway Mechanical Engineer, October, p. 57.
 A. A. R. electrical sections and manufacturers meet in Chicago. (18 000 words & fig.)

- 1948 625 .232 (73)
 Railway Mechanical Engineer, October, p. 84.
 Missouri Pacific buys 134 passenger cars for « Eagles » (2 200 words & fig.)

- 1948 621 .438 (73)
 Railway Mechanical Engineer, October, p. 92.
 GIGER (W.). — Gas turbine power. (3 000 words & fig.)

- 1948 625 .25 (06 (73)
 Railway Mechanical Engineer, November, p. 63.
 Air brake Association meeting. The A. B. load compensating brake. — Maintenance of H. S. C. brake equipment. — Type B. H. steam compressor governor. — Decelostats and decelostats sanding. — Maintaining mechanically driven air compressors. (7 000 words.)

- 1948 625 .28 (06 (73)
 Railway Mechanical Engineer, November, p. 75.
 Railway Fuel and Traveling Engineers' Association : SHERMAN (R. A.). — The field for steam motive power research.

- LLOYD (W. L.). — Procuring good coal for steam locomotives.

- RAYMOND (A. A.). — Causes of loss of steam locomotive availability.

- PAYNE (E. C.). — Mining and preparation of coal for locomotives.

- Training for Diesel locomotive operation. — Operation of Vapor-Clarkson steam generators. — Water treatment and fuel economy. — Training of locomotive firemen. — Coal. — Problems of railroad smoke abatement. (11 000 words.)

- 1948 625 .2 (06 (73)
 Railway Mechanical Engineer, November, p. 91.
 Car Department Officers' Association :
 GASS (A. H.). — How the car service division functions.
 ENNIS (W.). — Equipment failures and claim prevention.

- Report on passenger car painting.
 Problems in passenger car heating.
 Report on car-wheel shop practices.
 Report on car lubrication practices.
 Preparing cars for present-day operation.
 Committee report on A. A. R. loading rules.
 Interchange and billing for car repairs. (8 900 words & fig.)

University of Illinois Bulletin. (Urbana.)

- 1947 62 (01 (73) & 669 .1 (73)
 University of Illinois Bulletin, No. 26, December 18.
 MORKOVIN (D.) and SIDE BOTTOM (O.). — The effect of non-uniform distribution of stress on the yield strength of steel. (72 pages, illustrated.)

- 1947 921 .1 (73)
 University of Illinois Bulletin, No. 29, January 2.
 PECK (R.). — History of building foundations in Chicago. (62 pages, illustrated.)

- 1948 624 (0 (73)
 University of Illinois Bulletin, No. 31, January 12.
 NEWMARK (N. M.), SIESS (C. P.) and PECKHAM (W. M.). — Studies of slab and beam highway bridges. (60 pages, illustrated.)

- 1948 656 .211
 University of Illinois Bulletin, No. 32, January 17.
 TUTHILL (J. K.). — Highspeed freight train resistance its relation to average car weight. (77 pages, illustrated.)

- 1948 62 (01
 University of Illinois Bulletin, No. 33, January 22.
 WILSON (W. M.). — Flexural fatigue strength of steel beams. (32 pages, illustrated.)

In Spanish.

Boletín de la Asociación Permanente del Congreso Panamericano de Ferrocarriles. (Buenos Aires.)

- 1949 621 .33 (45)
 Boletín de la Asoc. Perm. del Congreso Panamericano de Ferroc., mayo-junio, p. 27.

- DI MAJO. — Electrificación y motorización de los Ferrocarriles Italianos. (4 500 palabras & fig.)

- 1949 385 .113 (73)
 Boletín de la Asoc. Perm. del Congreso Panamericano de Ferroc., mayo-junio, p. 92.

- NUÑEZ BRIAN (J.). — Resultados económicos de la explotación de los ferrocarriles de los Estados Unidos de América en el año 1948. (2 400 palabras & cuadros.)

- 1949 621 .431 .72 & 625 .616
 Boletín de la Asoc. Perm. del Congreso Panamericano de Ferroc., julio-agosto, p. 20.

- CAPPA (A.). — Características técnicas de locomotoras diesel-electricas para ferrocarriles de trocha angosta (1 metro). (17 000 palabras & fig.)

1949

385

Boletín de la Asoc. Perm. del Congreso Panamericano de Ferroc., julio-agosto, p. 78.

HORTON (G. C.). — Problemas ferroviarios contemporáneos y sugerencias para el estudio de sus soluciones. (12 000 palabras.)

Revista de Obras Públicas. (Madrid.)

1949

385 .11

Revista de Obras Públicas, octubre, p. 490.

DURAN (F.). — Aspecto económico de los ferrocarriles en construcción. (2 500 palabras.)

1949

691

Revista de Obras Públicas, noviembre, p. 548.

ECHEVERRÍA (F. G.). — Dosificación de hormigones. Nuevas orientaciones. (3 500 palabras & fig.)

In Italian.

Ingegneria ferroviaria. (Roma.)

1949

656 .212

Ingegneria ferroviaria, ottobre, p. 629.

CIOCIA (D.). — Le manipolazioni ed i trasporti di materiali nell'industria e negli impianti ferroviari. (7 000 parole & fig.)

1949

621 .332

Ingegneria ferroviaria, ottobre, p. 639.

PROIA (R.). — Perdite sulla linea di contatto di un impianto di trazione a corrente continua 3 000 V. (3 500 parole & fig.)

1949

621 .335 (45)

Ingegneria ferroviaria, ottobre, p. 657.

d'ARBELA (A.). — La nuove locomotive a quattro assi motori Gr. E. 424 delle Ferrovie dello Stato. (8 000 parole & fig.)

1949

656 .261

Ingegneria ferroviaria, ottobre, p. 669.

DEL GUERRA (G.). — Il trasporto su strada ordinaria di rotabili a carrelli. (1 000 parole & fig.)

Trasporti Pubblici. (Roma.)

1949

656

Trasporti Pubblici, maggio, p. 357.

DE DOMINICIS (G.). — Ferrovie Tranvie o Auto-linee? (4 000 parole & fig.)

1949

621 .335

Trasporti Pubblici, maggio, p. 371.

BONAIUTO-GRECO. — Confronto tra alcuni elementi costruttivi di locomotori elettrici alimentati a corrente continua e a corrente alternata. (1 000 parole & fig.)

1949

621 .335

Trasporti Pubblici, maggio, p. 374.

L'Elettrogiro della « Oerlikon ». (1 000 parole & fig.)

1949

385 .15 (45)

Trasporti Pubblici, giugno, p. 469.

FERRIOLO (V.). — Le gestioni governative di ferrovie concesse all'industria privata. (4 000 parole.)

1949

388

Trasporti Pubblici, giugno, p. 493.

Tranvie filovie e metropolitane. Studio economico comparativo dei diversi sistemi di trasporto pubblico urbano e suburbano. (1 500 parole & tavola.)

In Netherlands.

Spoor- en Tramwegen. (Utrecht.)

1949

625 .143 .4 (492)

Spoor- en Tramwegen, n° 20, 6 October, p. 311; n° 21, 20 October, p. 327.

WOLFERT (D.). — Het fabriceren, laden, vervoeren en lossen op de plaats van bestemming van in de spoorstaafslinrichting der N. S. elektrisch gelaste spoorstaven. (6 000 woorden & fig.)

1949

656 .256 .3 (492)

Spoor- en Tramwegen, n° 22, 3 November, p. 349.

VERSTEGEN (J. H.). — Invoering van automatisch blockstelsel met de nieuwe lichtseinbeelden op het baanvak Utrecht-Driebergen. (1 600 woorden & fig.)

1949

625 .13 (492)

Spoor- en Tramwegen, n° 23, 17 November, p. 365.

VAN DER VEEN (K. H. C. W.). — Vernieuwen van de bruggen over de Warmonder Leede. (5 000 woorden & fig.)

1949

621 .136

Spoor- en Tramwegen, n° 23, 17 November, p. 380.

KARSKENS (J. J.). — Stoom-tenderrem. (1 200 woorden & fig.)

In Norwegian (= 439.82)

Teknisk Ukeblad. (Oslo.)

1949

625 .28 (481) = 439.82

Teknisk Ukeblad, N° (28-32), p. 445.

GRONNINGSAETER (I.). — Some documentation on the appliances needed by the motive power of the Norwegian Railways. (6 300 words & fig.)

In Polish (= 91.885)

Przegląd Kolejowy. (Warsaw.)

1949

385 (437) = 91.885

Przegląd Kolejowy, No. 6, p. 162.

Reorganisation of the Polish State Railways. (4 500 words.)

1949

625 .26 = 91.885

Przegląd Kolejowy, No. 6, p. 166.

KROGULSKI (T.). — Repairs at regular intervals of railway rolling stock. (3 000 words & fig.)

In Swedish (= 439.71)

Nordisk Järnbanetidskrift. (Stockholm.)

1949

625 .17 (73) = 439.82

Nordisk Järnbanetidskrift, No. 3, p. 59.

SKJENNEBERG. — Means and methods of maintenance of the permanent way in the United States. (9 000 words & fig.)

MONTHLY BIBLIOGRAPHY OF RAILWAYS⁽¹⁾

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[016. 385. (02)

I. — BOOKS.

In French.

1948 625 .14 (493)

CAMPUS (R.).

Les progrès dans la constitution et l'entretien des voies ferrées du Réseau des chemins de fer belges.

Liège, A.I.Lg., éditeur, 12, quai Paul Van Hoegaerden, 1 brochure (21 × 30 cm) de 16 pages, avec 11 figures.

1949 621 .83

HENRIOT (G.).

Traité théorique et pratique des engrenages. Tome I. Paris, Dunod, éditeur. 1 volume (16 × 24 cm) de 351 pages et 306 figures. (Prix : 1 950 fr.fr.).

1949 621 .392 & 624 .92

KIENERT (G.).

Constructions métalliques rivées et soudées. Tome I : *Procédés sidérurgiques de construction. Organes de liaison. Assemblages-types.* — Tome II : *Les éléments de la charpente. Joints. Assemblages. Appuis.*

Paris, Editions Eyrolles, 61, boulevard Saint-Germain. Tome I : 1 vol. (16.5 × 25 cm), 164 p., 174 fig. (Prix : 860 fr. fr.). Tome II : 1 vol. (16.5 × 25 cm), 232 p., 320 fig. (Prix : 990 fr. fr.)

1949 625 .42 (44)

LEROUY (J.).

Le matériel roulant du Chemin de fer Métropolitain de Paris. Matériel de réseau urbain.

La Chapelle-Montligeon (Orne), Les Editions de Montligeon, éditeur. 1 volume (16 × 24 cm) de 142 pages avec de nombreuses figures.

1949 624 & 69

TIMOSHENKO (S.) & YOUNG (D.H.).

Théorie des constructions. Traduit de l'anglais, par F. SCHELL.

Paris et Liège, Librairie Béranger, éditeur. 1 volume (16 × 24 cm) de 566 pages, avec 477 figures et une planche hors-texte. (Prix : 2 100 fr. fr.)

In German.

1949 624

SCHAPER (G.).

Mauerwerk, Widerlager, Pfeiler und Gestaltung von Brücken. 4^e Auflage.

Berlin, Verlag Wilhelm Ernst & Sohn. 215 Seiten mit 306 Textabbildungen. (Preis : DM. 13.)

1948 62 (01)

ZILLICH-STIEGLER.

Statik, leicht verständlich dargestellt.

1. Teil : *Graphische Statik.* 16. Auflage. 74 Seiten mit 205 Textabb.

3. Teil : *Grössere Konstruktionen und Stahlbeton.* 15. Auflage. 92 Seiten mit 108 Textabb.

Berlin, Wilhelm Ernst & Sohn. (Preis : 1. Teil : DM. 3,—; 3. Teil : DM. 3.40.)

In English.

1949 385 (061.4 (73) & 656. 25 (73)

Association of American Railroads. — Signal Section proceedings. — Vol. XLVI, No. 2. Minutes, Fifty-first Annual Meeting, Chicago, Ill., September 12, 13 and 14, 1949.

One brochure (6 × 9 in.) of 120 pages, New-York 7, Published by the Signal Section A.A.R., 30, Vesey Street, N.Y.

1948 621 .392

KOENIGSBEGER (F.).

Design for welding in mechanical engineering.

London : Longmans, Green & Co. Ltd., 210 pp., 241 figs. (Price : 18 s.)

1949 624 .63

LEGAT (A.W.), DUNN (G.) and FAIRHURST (W.A.).

Design and Construction of reinforced concrete bridges. London : Concrete Publications, Ltd., 14, Dartmouth Street, S.W. 1. (Price : 30 s.)

1949 669

LORD (J.O.).

Alloy Systems. An Introductory Text.

New York, U.S.A. : Pitman Publishing Corporation, 2, West 45th Street. (Price : 5.60 \$)

London : Sir Isaac Pitman and Sons Limited, Pitman House, Parker Street, Kingsway, W.C. 2. (Price : 40 s. net.)

(1) The numbers placed over the title of each book are those of the decimal classification proposed by the Railway Congress conjointly with the Office Bibliographique International, of Brussels. (See « Bibliographical Decimal Classification as applied to Railway Science », by L. WEISSENBRUCH, in the number for November 1897, of the *Bulletin of the International Railway Congress*, p. 1509.)

- 1949 621 .32
MILLER (H.A.).
Cold cathode fluorescent lighting.
The Technical Press, Limited, Gloucester-road,
Kingston Hill, Surrey. (Price : 10 s. 6 d.)
- 1949 621 .3
ROBERTSON (B.I.) and BLACK (L.J.).
Electric Circuits and Machines.
New York 3 : D. Van Nostrand Company, Incorporated, 250, Fourth Avenue. (Price : 5 \$)
London : Macmillan and Company, Limited, St. Martin's Street, W.C. 2. (Price : 37 s. 6 d.)
- 1949 621 .9
SCHLESINGER (G.).
Testing Machine Tools. Fifth edition.
Brighton 1 : The Machinery Publishing Company Limited, National House, West Street. (Price : 17 s. 6 d.)
- 1948 621
SCORER (S.) (*Editor*).
The steam boiler year book and Manual IV.
London : Paul Elek Publishers Ltd., 589 pp., numerous illustrations. (Price in Great Britain : 30 s. net.)

- 1948 62
STUBBINGS (G.W.).
Dimensions in engineering Theory.
London : Crosby, Lockwood & Son Ltd., 104 pp.
(Price in Great Britain : 7 s. 6 d.)
- 1949 656 .25
TAYLOR (M.).
Railway Signalling.
London : Sampson Low, Marston & Co. Ltd., 25, Gilbert Street, W. 1, (7 3/4 × 5 in.), 84 pp. Illustrated. Paper covers. (Price : 3 s. 6 d.)
- In Italian.
- 1949 621 .116
CASALI (E.).
L'acqua delle caldaie a vapore ed il suo trattamento.
Milano, U. Hoepli, editore. 1 vol. in 8°, ill., di pagg. 195. (Prezzo : L. 1 000,—)
- 1949 625
STABILINI (L.).
Costruzioni stradali e ferroviarie. Vol. II.
Milano, Libreria Editrice Politecnica Cesare Tamburini. 1 vol. (18 × 25) di 307 pagg. e 600 fig. (Prezzo : L. 1 500.)

[016. 385. (05)]

II. PERIODICALS.

In French.

- Annales des ponts et chaussées. (Paris.)
- 1949 721 .1
Annales des ponts et chaussées, mars-avril, p. 289.
DURIEZ. — Note sur les nouvelles méthodes pour augmenter la *stabilité* et l'*imperméabilité* des terrains. (2 500 mots.)
- 1949 624 .2
Annales des ponts et chaussées, mai-juin, p. 407.
VOGEL (Th.). — *Vibrations d'une poutre continue* sous l'effet d'une charge mobile. (8 000 mots.)
- Bulletin des transports internationaux
par chemins de fer. (Berne.)
- 1949 385 .62 & 385 .63
Bulletin des transports intern. par ch. de fer, juillet, p. 237.
Longueurs kilométriques des lignes auxquelles s'appliquent la C. I. M. et la C. I. V. (500 mots et tableaux.)
- 1949 385 .62 & 385 .63
Bulletin des transports intern. par ch. de fer, juillet, p. 265.
Extrait du rapport de gestion pour l'année 1948 de l'Office central des Transports internationaux par chemins de fer. (4 500 mots et tableaux.)

- 1949 656 .227 (44)
Bulletin des transports intern. par ch. de fer, août, p. 290.
MÉDARD (L.). — Le Règlement français de 1945 pour le *transport des matières dangereuses*. (6 000 mots.)
- 1949 656 .223 .2 (469)
Bulletin des transports intern. par ch. de fer, août, p. 300.
dos SANTOS (A.). — Quelques questions de droit dégagées de la législation portugaise sur le *transport des wagons de particuliers*. (3 500 mots.)
- 1949 385 .113 (494)
Bulletin des transports intern. par ch. de fer, août, p. 320.
Rapport sur la *gestion et les comptes des Chemins de fer fédéraux suisses* pour 1948. (1 200 mots.)
- 1949 313 .385 (47.1)
Bulletin des transports intern. par ch. de fer, août, p. 322.
Les *Chemins de fer de l'Etat finlandais* en 1945. (Tableau.)
- Bulletin de la Société des Ingénieurs Civils
de France. (Paris.)
- 1948 385 (44)
Bull. de la Soc. des Ing. civils de France (mémoires), août, p. 269.
PARMANTIER. — Le rôle des *ingénieurs français* dans l'évolution des chemins de fer. (6 000 mots & fig.)

1948 **621** .33 (44)
 Bull. de la Soc. des Ing. civils de France (mémoires),
 août, p. 284.
ARMAND. — Une nouvelle orientation de la traction
 électrique. (3 000 mots.)

1949 **621** .392 (44) & **625** .23 (44)
 Bull. de la Soc. des Ing. civils de France, fascicule
 n^{os} 14 et 15, p. 150.
LEGRAND (Y.). — Généralités sur l'emploi de la
 soudure dans la conception des caisses des voitures métal-
 liques des chemins de fer. (1 200 mots.)

1949 **625** .212 (44)
 Bull. de la Soc. des Ing. civils de France, fascicule
 n^{os} 14 et 15, p. 152.
FOY. — Technique de construction des rames sur
 pneumatiques. Solution en acier inoxydable. (1 600 mots.)

1949 **625** .212 (44)
 Bull. de la Soc. des Ing. civils de France, fascicule
 n^{os} 14 et 15, p. 153.
VIVIEN-RAGUET. — La technique de construction
 de rames sur pneumatiques. Solution en acier ordinaire.
 (1 200 mots.)

1949 **625** .212 (44)
 Bull. de la Soc. des Ing. civils de France, fascicule
 n^{os} 14 et 15, p. 157.
LEROY (A.). — La technique de construction de
 rames sur pneumatiques. La solution en alliage léger.
 (1 600 mots.)

1949 **621** .131
 Bull. de la Soc. des Ing. civils de France, fascicule
 n^o 17, p. 185.
CHAPELON. — Le centenaire de la locomotive
 Crampton et un siècle de progrès en traction à vapeur.
 (1 000 mots.)

Notre Métier. (Paris.)

1949 **725** .33 (44)
 Notre Métier, 10 octobre, p. 6.
 La reconstruction du dépôt de Trappes. (1 500 mots
 & fig.)

1949 **625** .6 (493)
 Notre Métier, 17 octobre, p. 3.
VAN DEN EEDE (A.). — Chemins de fer Vicinaux
 belges. (2 000 mots, carte & fig.)

1949 **621** .132 .8
 Notre Métier, 17 octobre, p. 8.
DOERR (M.). — Automotrices à vapeur. (3 000 mots
 & fig.)

1949 **656** (42)
 Notre Métier, 24 octobre, p. 3.
 Les services routiers des chemins de fer et les progrès
 de la coordination en Grande-Bretagne. (1 500 mots
 & fig.)

1949 **656** .261 (44)
 Notre Métier, 7 novembre, p. 4.
FORCE (G.). — La remorque porte-wagon dessert
 l'embranchement S. I. M. C. A. (1 300 mots & fig.)

1949 **656** (44)
 Notre Métier, n^o 225 (numéro spécial).
Rail et Route en France. (24 pages avec de nombreuses
 illustrations.)

L'Ossature métallique. (Bruxelles.)

1949 **624** .62 (493)
 L'Ossature métallique, septembre, p. 377.
DORLET (E.). — Le pont-route de Fragnée à Liège.
 (5 000 mots & fig.)

1949 **625** .23 (42)
 L'Ossature métallique, septembre, p. 391.
 Les nouvelles voitures tout acier des Chemins de fer
 britanniques. (1 000 mots & fig.)

1949 **625** .13 (492)
 L'Ossature métallique, septembre, p. 395.
SCHOR (R. J.). — Montage du pont restauré sur le
 Lek, près de Vianen (Pays-Bas). (5 000 mots & fig.)

1949 **624** .32 (439)
 L'Ossature métallique, octobre, p. 431.
SZÉCHY (Ch.). — La reconstruction du pont-route
 sur la Tisza, à Szeged. (4 000 mots & fig.)

1949 **624** .51 (44)
 L'Ossature métallique, octobre, p. 455.
 La construction du nouveau pont suspendu à Valence
 sur le Rhône. (2 500 mots & fig.)

Revue générale des Chemins de fer. (Paris.)

1949 **621** .335 (44)
 Revue générale des Chemins de fer, septembre, p. 385.
TROLLUX. — La locomotive électrique CC 7001 de
 la S. N. C. F. (5 500 mots & fig.)

1949 **621** .431 .72 (44)
 Revue générale des Chemins de fer, septembre, p. 394.
ZENS (P.). — Un autorail léger pour lignes secon-
 daires. (1 300 mots & fig.)

1949 **341** .324 (43)
 Revue générale des Chemins de fer, septembre, p. 396.
KARST. — Les transports ferroviaires en zone fran-
 çaise d'occupation en Allemagne. (5 000 mots.)

1949 **656** .212 .5 (44)
 Revue générale des Chemins de fer, septembre, p. 402.
BRATIÈRES & VINOT. — Le triage de Toulouse-
 Saint-Jory. (4 500 mots & fig.)

1949 **385** .(07 .2 (44)
 Revue générale des Chemins de fer, septembre, p. 418.
 Remarques sur l'organisation à la S. N. C. F. de
 la Recherche appliquée. (5 000 mots & graphiques.)

1949 **656** .211 (45)
 Revue générale des Chemins de fer, septembre, p. 426.
 La nouvelle gare de Rome-Termini. (1 300 mots & fig.)

Trains. (Bruxelles.)

1949 621 .33 (493)
Trains, n° 15, p. 17.
MUSYCK (J.). — Pourquoi électrifier? (1 700 mots & fig.)

1949 621 .335 (493)
Trains, n° 15, p. 21.
GHILAIN (P.), GHINS (O.), BAEYENS (Fr.) et VERBEECK (H.). — Les locomotives électriques de la S. N. C. B. (9 000 mots, tableaux & fig.)

1949 621 .33 (493) & 656 .256 .3 (493)
Trains, numéro spécial, p. 5.
DERIJCKERE (E.-J.-F.). — Les installations fixes pour l'électrification des lignes de Bruxelles-Midi-Charleroi et Linkebeek-Anvers-Nord. (15 000 mots & fig.)

1949 621 .335 (493)
Trains, numéro spécial, p. 25.
GHILAIN (P.), GHINS (O.), BAEYENS (F.) & VERBEECK (H.). — Les locomotives électriques B.B.-130 km/h. (3^e série) ou locomotives type 121. (1 800 mots & fig.)

1949 621 .33
Trains, numéro spécial, p. 30.
VANDERBORCHT (J.) & MARCHAL (A.). — L'exploitation des lignes électriques. (10 000 mots & fig.)

1949 621 .33 (493) & 625 .1 (493)
Trains, numéro spécial, p. 41.
BOUCIQUE (J.). — Electrification des lignes de Bruxelles à Charleroi et de Linkebeek à Anvers-Nord. (6 000 mots & fig.)

In German.

Der Eisenbahnbau. (Frankfurt-Main.)

1949 624 (43)
Der Eisenbahnbau, Juli, S. 148.
HACHMANN (D.). — Brückentransportgerät der Reichsbahndirektion Hamburg. (2 000 Wörter & Abb.)

1949 625 .173
Der Eisenbahnbau, Juli, S. 154.
KUHN (F.). — Die Gleisstopfmaschine «Matisa». (2 200 Wörter & Abb.)

1949 385 .(09) (43)
Der Eisenbahnbau, August, S. 169.
HALANK (E.). — Die Bautätigkeit der Deutschen Reichsbahn. (10 000 Wörter & Abb.)

1949 625 .13 (43)
Der Eisenbahnbau, August, S. 182; September, S. 201.
HAGEMANN (A.). — Die Wiederherstellung der Eisenbahnbrücken im Vereinigten Wirtschaftsgebiet in den Jahren 1945 bis 1948. (5 000 Wörter & Abb.)

1949 625 .143.5 (43)
Der Eisenbahnbau, August, S. 187.
HESEBECK (H.). — Ein Vorschlag zur Schienenbefestigung auf Stahlbetonschwellen. (1 000 Wörter & Abb.)

1949

625 .144 .3

Der Eisenbahnbau, September, S. 206.
AMBERGER (E.). — Beitrag zum Übergangsbogen mit geschwungener Krümmungslinie. (2 400 Wörter & Abb.)

Glasers Annalen. (Berlin.)

1949 621 .132 .3 (44)
Glaser's Annalen, September, S. 149.
WOLFF (A.). — Neue 2D1-h4v-Schnellzug Lokomotiven, Serie 241-P der S. N. C. F. (5 000 Wörter, Tabellen & Abb.)

1949 625 .216
Glaser's Annalen, September, S. 154.
KESSLER (O.). — Die Pufferfeder und ihre Entwicklung. (4 000 Wörter & Abb.)

In English.

The Engineer. (London.)

1949 388 (42)
The Engineer, July 8, p. 50.
A railway plan for London. (1 200 words.)

1949 656 .254 (42)
The Engineer, July 8, p. 52.
L. M. R. telephone equipment at Crewe. (1 000 words & fig.)

1949 621 .131 .3 (42)
The Engineer, July 15, p. 65.
The locomotive interchange trials of 1948. (2 000 words & tables.)

1949 621 .431 .72 (42)
The Engineer, July 15, p. 76.
The Fell Diesel locomotive. (300 words.)

1949 621 .132 .1 (42)
The Engineer, July 29, p. 118.
POULTNEY (E.C.). — Two notable British locomotives. (1 800 words & fig.)

1949 621 .39 (42)
The Engineer, August 5, p. 154.
HARGREAVES (F.). — Stereoscopic radiography. (1 200 words & fig.)

1949 621 .431 .72 (73)
The Engineer, August 12, p. 168; August 19, p. 188; August 26, p. 217.
American Railroads. Diesel electric traction equipment in the United States and Canada. (7 000 words.)

1949 656 .254 (42)
The Engineer, August 12, p. 172.
Remodelling of Lime street station, Liverpool. (1 500 words & fig.)

1949 621 .331 (42)
The Engineer, August 12, p. 178.
Supervisory control for London Transport N. E. extension. (1 800 words & fig.)

1949 621 .134 .3 (42)
The Engineer, September 9, p. 289.
Locomotive variable cam poppet valve gear. (1 000 words & fig.)

Engineering. (London.)

1949 621 .335 (42)
Engineering, No. 4337, March 11, p. 234.
Mixed-traffic electric locomotive for Southern Region. (2 000 words & fig.)

1949 621 .33 (492) & 621 .431. 72 (492)
Engineering, No. 4338, March 18, p. 247.
VAN LESSEN (H.J.). — Electric and Diesel electric traction on the Netherlands Railways. (1 800 words.)

1949 621 .392 & 665 .882
Engineering, No. 4341, April 8, p. 317; No. 4342, April 15, p. 341.
WEST (E.G.). — Welding of aluminium and its alloys. (4 000 words.)

1949 656 .25 (42)
Engineering, No. 4341, April 8, p. 331.
Frequency-correction equipment for railway signalling circuits. (1 000 words & fig.)

1949 621 .431. 72 (42)
Engineering, No. 4346, May 13, p. 451.
330 B.H.P. direct-reversing Diesel locomotive. (800 words & fig.)

1949 621 .31
Engineering, No. 4349, June 3, p. 510.
MOTT (N.F.). — Semi-conductors and rectifiers. (2 000 words & fig.)

1949 624 (0)
Engineering, No. 4339, June 3, p. 517.
Simply-supported steel bridges. (1 400 words.)

Journal & Proceedings, Institution of Mechanical Engineers. (London.)

1949 621 .11
Journal & Proceedings, Institution of Mechanical Engineers, Journal, September, and Proceedings, Vol. 160, No. 2, p. 211.
LJUNGSTRÖM (F.). — The development of the Ljungström steam turbine and preheater. (7 000 words & fig.)

Modern Transport. (London.)

1949 656 .224 (42) & 656 .237 .2 (42)
Modern Transport, August 27, p. 4.
Mobile railway booking offices. (400 words & fig.)

1949 621 .131 .3 (42)
Modern Transport, August 27, p. 13.
Locomotive interchange trials. (1 000 words & tables.)

1949 656 .284 (42)
Modern Transport, August 27, p. 16.
Southern boiler failure. (1 200 words.)

1949 621 .338 (931)
Modern Transport, September 3, p. 7.
Electric motor coaches for New Zealand. (1 200 words & fig.)

1949 656 .281 (42)
Modern Transport, September 3, p. 8.
Derailment during track repairs. (900 words.)

1949 621 .438 (42)
Modern Transport, September 3, p. 15.
New general purpose gas turbine. (1 800 words & fig.)

1949 621 .132 .3 (42)
Modern Transport, September 10, p. 14.
POULTNEY (E.C.). — Evolution of 2-8-4 type locomotives. (1 600 words & fig.)

1949 621 .132 .7 (42)
Modern Transport, September 10, p. 17.
New shunting engine. W.R. outside cylinder 0-6-0 type. (200 words & fig.)

1949 621 .132 .6 (54)
Modern Transport, September 17, p. 15.
Metre-gauge locomotives for India. (400 words & fig.)

1949 621 .33 (42)
Modern Transport, September 24, p. 3.
Electric railway overhead gear box. (1 400 words & fig.)

1949 621 .335 (42)
Modern Transport, September 24, p. 12.
Notations for locomotive wheel arrangements. Dealing with electric and Diesel-electric units. (600 words & fig.)

The Oil Engine and Gas Turbine. (London.)

1949 621 .438 (73)
The Oil Engine and Gas Turbine, September, p. 167.
Locomotive unit for coal burning. (1 400 words & fig.)

1949 621 .438 (42)
The Oil Engine and Gas Turbine, October, p. 194.
Operating experience with the Parsons plant. (1 800 words & fig.)

1949 621 .438 (42)
The Oil Engine and Gas Turbine, November, p. 6.
Our first gas-turbine locomotive. Brown-Boveri 2 500 B.H.P. Double-bogie design for Express Passenger Service in the Western Region. (1 800 words & fig.)

Proceedings,
American Society of Civil Engineers.
(New York.)

- 1949 625 .13 (0)
Proceedings, American Society of Civil Engineers,
October, p. 1147.
STEINMANN (D.B.). — Aerodynamic theory of
bridge oscillations. (38 pages with figures.)

Proceedings
of the Institution of Electrical Engineers.
(London.)

- 1949 537
Proceedings of the Institution of Electrical Engineers,
October, Part II, p. 673.
GRIMMITT (H.W.). — Overhead line regulations.
(24 pages with tables & fig.)
- 1949 537
Proceedings of the Institution of Electrical Engineers,
October, Part II, p. 769.
RIPPON (E.C.). — The detection by oscillographic
methods of winding failures during impulse tests on
transformers. (19 pages with figures.)

Railway Age. (New York.)

- 1949 621 .431 .72 (73)
Railway Age, August 6, p. 38.
BARR (D.M.). — Six-motored Diesels for hump
yard service. (800 words & fig.)
- 1949 621 .138 .1 (73)
Railway Age, August 6, p. 40.
MAY (H.E.). — Abatement of smoke and cinders on
locomotives and at enginehouses. (1 200 words.)
- 1949 621 .131 .2 (73)
Railway Age, August 13, p. 56.
O' CONNOR (CHADWELL). — Is further steam
development practical? (1 600 words.)
- 1949 656 .212 (73)
Railway Age, August 13, p. 64.
Freight terminal built for efficiency. (2 000 words
& fig.)
- 1949 625 .244 (73)
Railway Age, August 20, p. 47.
Thermostats on heated refrigerator cars. (2 800 words
& fig.)
- 1949 656 .212 (73)
Railway Age, August 27, p. 32.
Station remodelled on functional lines. (1 600 words
& fig.)
- 1949 625 .144 .4 (73)
Railway Age, August 27, p. 37.
New Pullman standard ballast cleaner. (1 200 words
& fig.)

- 1949 625 .164 (73)
Railway Age, March 12, p. 60.
LEWIS (R.G.). — Blizzard of 49 produces new
strategies in snow fighting. (2 200 words & fig.)

- 1949 656 .254 (73)
Railway Age, March 12, p. 90.
End-to-end communication pays off on the « Q ». (1 200 words & fig.)

Railway Mechanical Engineer.
(Chicago.)

- 1949 621 .438 (73)
Railway Mechanical Engineer, July, p. 363.
EGBERT (P.T.) and WILSON (G.W.). — The
Alco-G.E. Gas-turbine-electric locomotive. (3 000 words
& fig.)
- 1949 625 .28 (73)
Railway Mechanical Engineer, July, p. 369.
A. C. F. Talgo train. (3 000 words, tables & fig.)
- 1949 621 .431 .72 (73)
Railway Mechanical Engineer, July, p. 377.
BREHOB (F.A.). — Diesel locomotive engine cooling
system. (2 400 words & fig.)
- 1949 625 .24 (73)
Railway Mechanical Engineer, July, p. 384.
VASSICK (L.R.). — Soo Line builds all-welded
gondolas. (2 000 words & fig.)
- 1949 656 .215 (73)
Railway Mechanical Engineer, July, p. 401.
Lighting a terminal yard. (2 000 words.)

Railway Gazette. (London.)

- 1949 656 .281 (42)
Railway Gazette, No. 10, September 2, p. 279.
Ministry of Transport Accident Report : Near Lough-
borough, Eastern Region, British Railways, January 9,
1949. (1 500 words & fig.)
- 1949 385 .3 (42)
Railway Gazette, No. 11, September 9, p. 293.
British Transport Commission's First Year. Summary
of the annual report. (5 000 words & tables.)
- 1949 621 .338 (931)
Railway Gazette, No. 11, September 9, p. 301.
New electric train sets for the New Zealand Govern-
ment Railways. (800 words & fig.)
- 1949 621 .335 (73)
Railway Gazette, No. 11, September 9, p. 303.
New Virginian Railroad Electric locomotives. (800
words & fig.)
- 1949 656 .212 .5 (71)
Railway Gazette, No. 11, September 9, p. 305.
New hump-retarder yard at Montreal, Canadian
Pacific Railway. (400 words.)

1949 624 .63 (42) & 691 (42)
 Railway Gazette, No. 12, September 16, p. 331.
Overbridges for Penistone-Wath electrification. (300 words & fig.)

1949 656 .284 (42)
 Railway Gazette, No. 12, September 16, p. 341.
Ministry of Transport Accident Report : Southampton, Southern Region, British Railways, April 6, 1949.

1949 621 .134 .3 (42)
 Railway Gazette, No. 13, September 23, p. 355.
Infinitely variable R. C. poppet valve gear. (800 words & fig.)

1949 313 .385 (42)
 Railway Gazette, No. 13, September 23, p. 366
British Transport Commission Statistics. Summary of the principal statistics for the four-week period ended July 17. (300 words & tables.)

1949 656 .284 (42)
 Railway Gazette, No. 13, September 23, p. 368.
Ministry of Transport Accident Report : Between Cowden and Hever on the Southern Region, British Railways : December 7, 1948. (800 words.)

1949 621 .134 .3
 Railway Gazette, No. 14, Sept. 30, p. 385; Oct. 7, p. 415.
 McARD (G.W.). — Locomotive valves and valve gears. (4 000 words & fig.)

Railway Mechanical Engineer. (New York.)

1948 621 .13 (06 (73)
 Railway Mechanical Engineer, November, p. 105.
 Master Boiler Makers' Association :
Stiglmeier discusses motive-power trends.
 PAYNE (Earl C.). — The outlook for coal-burning steam locomotives.
 HEATH (R.L.). — Alloy steels for welded boilers.
 RAYMO (A.J.). — Steels and their edge preparation.
 CROSSET (J.W.). — Welding test of nickel steel.
 MERRILL (T.W.). — Manganese-vanadium steel.
 MILLER (A.L.). — Welding stainless steels.
 R.W. BARRETT on inspection laws. — Experience of the Reading. — Shop and terminal handling. — Minimizing repair work. — Progress on the N. & W. — Improving steaming qualities of steam locomotives. (7 000 words.)

University of Illinois Bulletin. (Urbana.)

1947 625 .143
 University of Illinois Bulletin, No. 46, March 28.
 CRAMER (R.E.), ALLEMAN (N.J.) and JENSEN (R.S.). — Progress reports of investigation of railroad rails and joint bars. (46 pages, illustrated.)

1947 625 .14 (0
 University of Illinois Bulletin, No. 51, April 22.
 SMITH (R.), PECK (R.B.) and THORNBURN (T.H.). — Second progress report of the investigation of methods of roadbed stabilization. (55 pages, illustrated.)

1948 662
 University of Illinois Bulletin, No. 48, April 7.
Papers presented at the Seventh short course in coal utilization, held at the University of Illinois, September 17-19, 1946. (192 pages, illustrated.)

1948 697
 University of Illinois Bulletin, No. 55, May 12.
Papers presented at the First short course on hot water and steam heating systems, held at the Undergraduate Division, University of Illinois, Navy Pier, Chicago, September 9-11, 1947. (108 pages, illustrated.)

In Danish. (= 439 .81)

Ingeniøren. (Copenhagen.)
 1949 656 .21 (494) : 439 .81
 Ingeniøren, n° 39, p. 779.
 VEJLØ. — **Reconstruction of Zurich station.** (2 500 words & fig.)

In Spanish.

Derecho de Transportes. (Madrid.)
 1948 347 .762
 Derecho de Transportes, n° 1, p. 21.
 La prescripción de acciones en el contrato de transporte terrestre. (7 000 palabras.)

Ferrocarriles y Tranvías. (Madrid.)

1949 625 .154
 Ferrocarriles y Tranvías, septiembre, p. 338.
 MILLARUELO (J.L.). — Nota sobre tipos de puentes giratorios para locomotoras. (4 500 palabras & fig.)
 1949 656 .251
 Ferrocarriles y Tranvías, septiembre, p. 343.
 LATORRE (E.C.). — La óptica en la señalización ferroviaria. (5 000 palabras & fig.)

1949 625 .232
 Ferrocarriles y Tranvías, octubre, p. 383.
 GOICOECHEA OMAR (A.). — Atención al tren Talgo. (2 500 palabras.)

In Italian.

Giornale del Genio Civile. (Roma.)

1949 624 .2
 Giornale del Genio Civile, settembre, p. 423.
 CASTIGLIA (E.). — Equazioni e proprietà analitiche delle linee d'influenza nella trave continua. (5 000 parole, tavole & fig.)
 1949 624 .2
 Giornale del Genio Civile, settembre, p. 458.
 CATTIN (A.). — Trave continua inflessa e assialmente sollecitata da una forza variabile linearmente. (2 000 parole & fig.)

1949 624 .63 (45)
Giornale del Genio Civile, ottobre, p. 513.
RINALDI (G.). — Utilizzazione di travi metalliche tipo « Flambo » residue di guerra per ricostruzione di ponti permanenti in cemento armato di piccola luce. (500 parole & fig.)

L'Ingegnere. (Milano.)

1949 624
L'Ingegnere, luglio, p. 722.
CALBIANI (A.). — Ponteggi tubolari nelle centine per ponti. (2 000 parole & fig.)

1949 621 .116
L'Ingegnere, luglio, p. 731.
TAUFFER (F.). — La depurazione dell'acqua d'alimentazione delle caldaie ad alta pressione. (2 000 parole, tavole & fig.)

1949 624 .32 (45)
L'Ingegnere, agosto, p. 851.
COLLURA (P.). — Il vecchio e nuovo ponte in ferro stradale sul fiume Adige presso Rovigo. (4 000 parole, tabelle & fig.)

In Netherlands.

Spoor- en Tramwegen. (Utrecht.)

1949 625 .245 (492)
Spoor- en Tramwegen, N^o 24, 1 December, p. 395.
WERVERS (J. H.). — Nieuwe ketelwagens voor Nederlandse Maatschappijen. (1 200 woorden & fig.)

1949 621 .335 (492)
Spoor- en Tramwegen, N^o 24, 1 December, p. 401.
NYMEYER (A. G.). — Franse elektrische locomotieven op de lijnen der N. S. (3 500 woorden & fig.)

1949 621 .133 .2
Spoor- en Tramwegen, N^o 24, 1 December, p. 404.
VAN WIJCK JURRIAANSE (N. J.). — Ketels met stalen vuurkist. (2 500 woorden & fig.)

1949 621 .335 (44)
Spoor- en Tramwegen, N^o 18, 8 September, p. 287; N^o 21, 20 October, p. 331; N^o 22, 3 November, p. 358; N^o 23, 17 November, p. 375; N^o 24, 1 December, p. 386.
NYMEYER (A. G.). — Sud-Express. (Vervolg.) (17 000 woorden & fig.)

In Portuguese.

Técnica. (Lisboa.)

1949 385 (09 (44)
Técnica, n^o 195, outubro, p. 599.
LEMAIRE (M.). — L'évolution des Chemins de fer français. (7 000 palavras & fig.)

1949 721 .1
Técnica, n^o 195, outubro, p. 619; n^o 196, novembro, p. 669.
DOS SANTOS (M. P. Pereira). — A Mecânica de solo e as suas aplicações. (17 000 palavras & fig.)

In Polish. (= 91 .885)

Przegląd Komunikacyjny. (Warsaw.)

1949 656 = 91 .885
Przegląd Komunikacyjny, No. 6, p. 166.
SKOPINSKI (L.). — Savings in transport matters. (4 000 words.)

In Swedish. (= 439 .71)

Nordisk Järnbanetidskrift. (Stockholm.)

1949 625 .28 (73) = 439 .81
Nordisk Järnbanetidskrift, No. 4, p. 93.
THOMSON (E. Risbjerg). — Traction methods in U. S. A. — Report on a journey during the winter. (2 000 words & fig.)

1949 656 .212 .9 (44) = 439 .71
Nordisk Järnbanetidskrift, No. 4, p. 110.
NELANDER (O.) & ENOCSON. — Receiving of small parcels traffic in Paris. (2 200 words & fig.)

1949 625 .143 .3 = 439 .71
& 625 .212 = 439 .71
Nordisk Järnbanetidskrift, No. 5, p. 136.
LANDIN (C.) & RYDBERGH (A.). — Measures taken to reduce the wear of wheel rail contact. (2 200 words & fig.)

Statsbaneingenjören. (Stockholm.)

1949 625 .162 = 439 .71
& 656 .254 = 439 .71
Statsbaneingenjören, No. 6, p. 155.
HÅRD (T.). — From the level-crossing gates moved by hand to the automatic level-crossing gates. Retrospective survey made for a report of 1918 concerning the safety measures at level-crossings. (2 700 words.)

1949 625 .162 = 439 .71
Statsbaneingenjören, No. 6, p. 161.

HÅRD (T.). — Must wood or metal be used for draw level-crossing gates? (300 words.)

Teknisk Tidskrift. (Stockholm.)

1949 625 .13 = 439 .71
Teknisk Tidskrift, No. 34, p. 661.
MALMBERG & WARRE. — Replacement of a rail-bridge in 3 hours. (800 words & fig.)



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